HANDBOOK SUPPLEMENT

TO THE

ALBERTA

PRIVATE SEWAGE TREATMENT

AND DISPOSAL REGULATIONS

Alberta
LABOUR

Plumbing and Gas Safety Standards
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INTRODUCTION

This manual has been prepared to assist, in the selection and installation of private sewage treatment and disposal systems which are best suited to location, water and soil conditions, with consideration given to disposal of sewage wastes in a safe and efficient manner.

The improper disposal of sewage can foul the air, pollute the soil and endanger the drinking water of yourself, your neighbours, or even a remote community. Therefore, every sewage disposal system in the province is required to comply with the requirements of the **Private Sewage Treatment And Disposal Code.** This manual will help you to understand those requirements.

The Private Sewage Treatment and Disposal Code has been developed as a separate document, and outlines the minimum requirements that shall be maintained in the Province of Alberta to ensure the safe health and environment of all Albertans.

Readers are encouraged to consult the index in both this manual and the Code, to find sections relating to their specific interests and needs.

Do not hesitate to contact your local " Plumbing and Gas Inspector" for advice and assistance before any work is commenced.

NOTE:

All persons making use of this document are reminded that it has no legislative sanction. It has been prepared for convenience of reference only. The original Act and Regulation should be consulted for all purposes of interpreting and applying the law.

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PART 1 - PIPING

PIPING

All piping must be CSA "Certified", or certified by a recognized testing agency to meet or exceed the requirements of the appropriate CSA standard.

If plastic pipe is used to connect to the inlet or the outlet of a septic tank, such plastic pipe must not be lighter than D.W.V. (1/4" wall thickness), within 1.8 m (6 feet) of the septic tank or sewage holding tank.

BUILDING DRAIN

The building drain is the piping which conducts the sewage from the building to a point 1 m (3 feet) outside the building. In many cases, the building drain connects directly to the septic tank.

If the plumbing system serves no more than three bathrooms (along with the kitchen and laundry fixtures), the main building drain may be 3 inch piping to the septic tank. A 3 inch building drain should be graded at not less than 2% (1/4 inch per foot). A 4 inch building drain should be graded at not less than 1% (1/8 inch per foot).

BUILDING SEWER

The building sewer connects to the building drain at a point 1 m (3 feet) outside the building and may extend to the property line, a sewage lagoon or connect to a septic tank or sewage holding tank. The building sewer may be of cast iron soil pipe, vitrified clay tile, asbestos cement sewer pipe, concrete sewer pipe, or plastic sewer pipe. Extended "Y" cleanouts must be installed at intervals not exceeding 25 m (85 feet).

EFFLUENT SEWER

The effluent sewer connects to the outlet of a siphon type septic tank and, conveys effluent from the septic tank to an effluent disposal system. An effluent sewer may also extend from inside an access opening extension, for ease of access and connection to the pump discharge line. The effluent sewer may be 3 or 4 inch pipe, and should be laid on an even continuous grade of not less than 2% (1/4 inch per foot) if 3 inch, and 1% (1/8 inch per foot) if 4 inch. If plastic pipe is used, it must be not lighter than D.W.V. (1/4" wall thickness) within 1.8 m (6 feet) of the tank or access opening extension and preferably until it rests on solid, undisturbed ground.

EFFLUENT LINE

An effluent line is a pump discharge line. This line carries effluent from the pump chamber to an effluent disposal system and is normally polyethylene pipe. Pipe size may vary in diameter from 3/4 inch to 2 inch depending on it's application. Piping used for this application should have at least a 500 kpa (75 psi) rating. All fittings should be nylon or stainless steel and clamps should be of all stainless steel construction.

WEEPING LATERALS

Weeping laterals are lengths of perforated piping in a disposal field. The manufacturers label or identification on the pipe will be at the top centre when the pipe is in it's proper installed position. Plastic piping may be smooth as in the case of ABS or PVC piping or, it may be corrugated polyethylene. All piping must be certified as complying with CAN/CSA B182.1-87. **In all cases, piping approved for use as weeping laterals comes in straight lengths, piping that comes in a coil (corrugated piping used for sub-soil seepage), is not acceptable.** Perforated piping is always installed in gravel and nominally level.

LATERALS

Laterals for a mound type effluent disposal system are usually constructed of PVC plastic piping not smaller than 1 1/4 inch or larger than 2 inch. The distribution holes are drilled as required for each installation. The size and spacing of the perforations is dependant upon the length of the lateral, and the amount of effluent to be discharged in a specific period of time, depending on pump head pressure. Extreme care and caution must be exercised in the design and manufacture of laterals to obtain even distribution of effluent throughout the treatment mound.

LAYING SEWER PIPE

All gravity sewer piping must be graded and water-tight. Lay pipe on a firm trench bottom, and carefully compact the backfill on the sides of the piping to prevent the piping from becoming oval shaped or breaking under the weight of the backfill above it. Maintain an even and constant rate of fall. Sags cause stoppages. **See Fig. Pipe 1 (Page 24).**

PART 2 - FROST PROTECTION

FREEZING OF SYSTEMS

A properly installed treatment and disposal system has an excellent chance of surviving even the most extreme winters if a few simple precautions are taken.

Do not allow any household sewage to bypass the septic tank. Systems which do not receive bathroom sewage or hot water are more likely to freeze.

Insufficient earth cover on the septic tank may admit air and frost to the contents. The result will be a decrease in bacterial activity and a colder effluent that may freeze in the effluent treatment and disposal system. The admission of chemicals or antiseptics may have a similar effect.

Siphon or pump chambers assist with the frost prevention by saving up the effluent and then flushing it rapidly past cold sections whereas, a trickle system would freeze.

The liberal use of clean course gravel under weeping laterals allows the effluent to leave the weeping lateral quickly and greatly assists in the prevention of frozen disposal fields.

PROTECTING SEWERS FROM FROST AND TRAFFIC

All sewer piping located under a driveway, road, path, or bare yard, with less than 1.2 m (4 feet) of earth cover, should be protected by a "frost box." **See Fig. Frost 1 (Page 25).** The frost protection should terminate 1 m (3 feet) from the building wall. If carried to the wall, it may conduct odours to the building.

Where the septic tank is installed at or above the normal ground level (as would be the case with a siphon type of septic tank), and is located within 1 m (3 feet) from the building, frost protection may be provided by .4 m to .6 m (1 1/2 to 2 feet) of mounded earth cover. Tamp clay tightly around the building drain for this 1 m (3 foot) interval.

Note: In cases where it is necessary to locate the septic tank some distance from the house, and the building sewer requires protection, the frost box should terminate 1 m (3 feet) from the building wall. If carried to the wall, it may conduct odours to the building. Tamp clay tightly around the building drain for this 1 m (3 foot) interval.

PART 3 - SEPTIC TANKS AND SEWAGE HOLDING TANKS

SEPTIC TANK

A septic tank or sewage holding tank must be CSA certified and/or constructed and tested in accordance with the CAN3-B66-M90 Standard by a recognized testing agency.

PURPOSE

The septic tank is essentially a water-tight storage container into which raw sewage is discharged and retained for 24 hours or more. It's purpose is primarily to allow solids in the sewage to settle out (sludge) or to float (scum) thereby permitting the liquid portion of the sewage to leave the tank comparatively free of settleable and floating solids.

Sewage which has emerged from a septic tank is termed " Effluent." The subject of sewage treatment and disposal falls into two distinct stages:

(a) the retention and digestion of floating and settleable solids in the septic tank; and

(b) the safe treatment and disposal of the effluent.

HOW THE SEPTIC TANK WORKS

It is imperative that the septic tank owner thoroughly understands the dangers related to sewage.

The septic tank largely accomplishes it's purpose through the digestion of the sewage by **anaerobic bacteria.** These anaerobes are present in body wastes. They thrive in an environment which is warm, wet, dark and devoid of fresh air. The septic tank simply allows the sewage to rest for a 24 hr. period under these conditions, so that rapid multiplication of bacteria takes place.

This digestion will establish itself spontaneously in a tank receiving normal household sewage providing temperatures are not extreme and the proper environmental conditions exist in the septic tank. Tanks started in cold weather should be partially or totally filled with hot water to assist the growth of anaerobic bacteria.

USE OF THE SEPTIC TANK

All normal household wastes including the bath, water closet, basin, kitchen sink, and laundry must discharge to the septic tank. Appreciable amounts of lye, strong caustics, acids, disinfectants and other materials which are likely to adversely affect the development of bacteria, should not be admitted to the septic tank. Small amounts of hypochlorite or household bleaches such as those used to disinfect water supplies or to sterilize dishes will not reduce the septic action, but habitual admission of large amounts may be detrimental.

Rain water, and seepage water should not be admitted to the system. Any excessive volume of cold water from any source may wash away and seriously deplete the bacteria population in the tank as well as lowering the operating temperature.

Laundries, hospitals, large public kitchens, etc., may be expected to contribute volumes of wastes which would be better handled by a separate system. An engineer should be consulted in these or any other unusual cases.

LOCATION OF THE SEPTIC TANK

See the Code for minimum distance requirements.

The prime considerations in locating a septic tank are:

(a) Protection of the potable water supply. The septic tank is considered to be a water-tight component of the disposal system, however piping connections, access cover extensions, etc. may be subject to leakage after installation due to settling or other reasons.

(b) The type of septic tank being used (pump or siphon). **See Figures Tanks 1, Tanks 2 and Tanks 3 (Page 26, 27, & 28).**

(c) The depth of bury over the septic tank. **The maximum depth of bury over a septic tank is specified by the tank manufacturer.** You may wish to consider locating the septic tank a remote distance from the house to avoid excessive depth of bury or additional costs of access cover extensions versus frost protection. **See Fig. Tanks 3 (Page 28) and Fig Frost 1 (Page 25).**

(d) Access for cleaning. The general planning should be to locate the septic tank adjacent to the bathroom, on the opposite side of the house from the water supply, and where it is readily accessible for cleaning. Keep in mind that the septic tank must be cleaned periodically and must be accessible for a vacuum truck.

TO SELECT THE SIZE OF THE SEPTIC TANK

For single family dwellings and duplexes refer to the Table in the Code.

For other than single family dwellings or duplexes refer to the Tables in the Code to determine the expected volume of sewage per day. The total expected volume of sewage per day shall determine the minimum **"working capacity"** of the septic tank.

The **"working capacity"** of the septic tank means the liquid volume of sewage that will remain in the settling chamber (first compartment) when the tank is in normal use, but does not include the air space, siphon, pumping, or effluent chamber (second compartment). It is important to note that when reference is made to sizes and capacities of tanks, one should not consider the volume of the siphon or pump chamber in these figures. The effluent chamber is usually constructed as an integral part of the structure but does not contribute to the "working capacity" of the septic tank. **The minimum "working capacity" of a septic tank shall not be less than 1800 litres (400 Imperial gallons).**

To accommodate waste from garbage grinders, septic tanks should have their capacity increased by 50% or the tank should be cleaned every year.

TYPES OF SEPTIC TANKS

Numerous septic tanks are available in various types and sizes suitable for domestic use:

(a) Single compartment trickle tanks, **Note:** Single compartment trickle tanks may not be used alone, but may be used in conjunction with other septic tanks.

(b) Double compartment Pump tanks,

(c) Double compartment siphon tanks.

The shapes are usually a rectangular box however, may be a horizontal or vertical cylinder, or a sphere. They are manufactured from durable materials such as concrete, fibreglass, polyethylene and steel.

Septic tanks must be sized to accommodate the estimated sewage flow. Where a large tank is not available, several smaller tanks may be installed in series to provide the working capacity required. **See Fig. DF 14 (Page 44).**

SINGLE COMPARTMENT (TRICKLE TYPE) SEPTIC TANKS

A single compartment septic tank may not be used to trickle effluent directly into an effluent disposal system. Trickle type septic tanks are generally limited to the uses shown in **Fig. DF 14 (Page 44).**

DOUBLE COMPARTMENT (PUMP OR SIPHON) SEPTIC TANKS

The first compartment or settling chamber must hold not less than 1800 litres (400 Imperial gallons) of sewage. This is referred to as the **"working capacity"** of the septic tank. The second compartment in a septic tank is referred to as the **"effluent chamber."**

EFFLUENT CHAMBER - (SIPHON OR PUMP) - PURPOSE

The effluent chamber although usually constructed as an integral part of the septic tank, should be considered part of the effluent disposal system, it contributes nothing to the treatment of the effluent. By saving up the effluent and discharging it rapidly and intermittently it provides:

(a) a more even distribution of effluent throughout the disposal field,

(b) the important rest period for aeration of the disposal field, and

(c) some protection against freezing.

CAPACITY OF EFFLUENT CHAMBERS

The volume of discharge from the effluent chamber varies in size with the capacity of the effluent chamber, and the length of weeping lateral that it discharges into. The length of weeping lateral is dependant on the expected volume of sewage per day, and the percolation rate of the soil. Heavier soils require a longer rest period between flushes and of course, more weeping lateral footage, therefore, the capacity of the effluent chamber should be adequate to flush 4 to 8 litres per meter (1/4 to 1/2 gallon per foot) of weeping lateral.

In a mound, the effluent chamber should be sized to discharge not more than 25% of the expected volume of sewage per day.

It is not always possible to obtain a septic tank with the ideal size of effluent chamber or volume per flush. It is however possible to adjust the location of the pump controls to set the pump to turn on and off at specific levels to discharge a measured amount of effluent as required. In siphon type septic tanks or pump type septic tanks having small effluent chambers, it may be advisable to consider the installation of a Split field to better match the volume per flush with the length of weeping lateral. Please refer to the Disposal Field section for information regarding Split Fields.

For larger installations, it may be necessary to install another tank after the septic tank(s) to act as a separate effluent chamber and provide a sufficient volume of effluent per flush into the disposal system. Here again the split field may be considered. **See Fig. DF 14 (Page 44).**

ELEVATIONS

One disadvantage of a siphon tank is the loss of elevation in the system. **See Fig. Tanks 2 (Page 27).** The loss in elevation in a septic tank with siphon varies widely from about 20 inches to 32 inches depending upon the size and design of the siphon.

Fig. Tanks 2 (Page 27) illustrates why, in a level area, the building drain must be located at, or above, ground level if the discharge pipe from the siphon chamber is to be at a level which will provide a proper depth of .3 m to .6 m (12 to 24 inches) for the disposal field. It is necessary to mound the earth over the septic tank higher than the original ground level.

EXCAVATION FOR THE SEPTIC TANK OR SEWAGE HOLDING TANKS

Care must be taken in the excavation for the septic tank or sewage holding tank to ensure the excavation has a flat, undisturbed base to support the weight of the tank and it's contents. If the excavation is dug too deep and the tank is installed on uncompacted fill, the tank will settle and damage to the connecting piping may result as shown in **Fig. Tanks 4 (Page 29).** If a siphon type septic tank is used, the operation of the siphon may also be severely impaired resulting in the outlet piping being graded the wrong way.

MAINTENANCE AND CLEANING THE SEPTIC TANK

If the septic tank is not cleaned soon enough, the detention period which it will provide for the sewage, will continue to decrease. As a result, more and more suspended solids will be carried into the effluent disposal system, and the percolation surface of the soil will become clogged and eventually a complete blockage and failure of the system will result. The septic tank can usually be cleaned many times for the price of installing a new effluent disposal system:

The size of the septic tank determines little more than the intervals between cleanings. The septic tank should be checked each spring or early summer for the amount of accumulated sludge and scum in it. A septic tank with .45 m (18 inches) of sludge is ready to be cleaned. Cleaning the tank in the spring will allow bacterial action to have a chance to re-establish a normal digestive action through the summer. It is not necessary to thoroughly scrub and flush the septic tank chamber until it is visibly clean. The small amount of sludge that will remain on the floor and walls when the tank is emptied will re-seed the septic tank and contribute to the re-establishment of its normal operation. Vacuum-pumped sewage hauling trucks are available commercially to clean septic tanks. Such equipment is capable of doing an excellent cleaning job without spillage.

SLUDGE AND SCUM

Not all suspended matter in raw sewage is digestible in the septic tank. Some of the solids settle out and become sludge in the bottom of the tank. Grease and oily substances, rise to the surface and along with minute particles of suspended solids eventually form a thick scum. The scum, being buoyant, floats partly above the water line (27%), and for this reason a 9 inch minimum freeboard of "Depth of Air Space" is required in each septic tank. The accumulated scum roughly averages half the volume of the accumulated sludge. During cleaning the scum should not be unduly disturbed as it provides a layer of insulation against heat loss and also seals the air away from the digestive anaerobes.

THE DISPOSAL OF SLUDGE

Many of the pathogenic or disease producing bacteria found in sewage are capable of becoming spores, in which state they can withstand extreme cold or heat and extended drying conditions. For this reason, effluent or sludge from the septic tank should not be used to water or fertilize gardens.

If the contents of a septic tank, or sewage holding tank are spread on a field of summer fallow, where it will be well away from buildings or animals, it will rapidly become inoffensive and is a good nitrate fertilizer. Burial and covering is always an excellent method. Never permit sludge to contaminate any surface waters.

SEWAGE HOLDING TANKS

In areas where the minimum distances cannot be provided for other forms of disposal, it may be necessary to install a water tight sewage holding tank and haul all sewage away for disposal in a suitable location. The high cost of operation dictates that this method be used only where absolutely necessary.

DANGER

Deadly gases are present in a septic or sewage holding tank. **Never enter septic or sewage holding tanks unless the procedure and methods approved by Occupational Health and Safety have been carefully met.**

PART 4 - PUMPS

PUMPING OF SEWAGE

It is often desirable to have plumbing fixtures located in the basement. If the building is located near a hill side, the building drain may be located below the basement floor, and a comparatively simple system of sewage disposal may be installed that may not require a pump, if flow can be obtained by gravity.

If there is not sufficient slope on the ground surface to permit the use of this method, sewage or effluent may be raised to an elevation suitable for the disposal of effluent by the installation of a "Raw Sewage Lift Pump" or an "Effluent Pump." **See Figs. Pumps 1, Pumps 2, and Pumps 3 (Page 30, 31, & 32).**

RAW SEWAGE LIFT PUMPS (Fig. Pumps 1 Page 30).

Systems can be installed where raw sewage is pumped to a higher elevation where it can then run by gravity to the septic tank.

It is generally preferred to have all main and upper floors of a building drain to a siphon type septic tank by gravity and only the basement plumbing fixtures drain to a raw sewage lift pump. The raw sewage lift pump discharges the sewage from the basement fixtures into the building drain where it too can flow by gravity to the septic tank. This system requires the purchase of a pump capable of handling solids.

EFFLUENT PUMPS

It is sometimes necessary to install the septic tank deep enough to receive all sewage from the building by gravity, and to raise only the effluent to a suitable disposal level. An effluent pump must be specified by the manufacturer to be suitable for handling " effluent."

The most popular method of pumping effluent uses a submersible effluent pump installed in the effluent chamber of the septic tank. **Due to the presence of dangerous gases in septic tanks, it is imperative that special provisions for the installation, removal and servicing of the pump and controls be provided so that entering of the tank is not required.**

Another method of effluent pumping is to install a non-submersible effluent pump in the basement. This requires the installation of a suction line from the septic tank to the pump and a discharge line to the point of disposal.

SUBMERSIBLE EFFLUENT PUMP CONTROLS

It is essential that no electric motors, wiring, switches, or working parts of the effluent pumping system be subjected to the highly corrosive and deteriorating effects of the atmospheric conditions which exist in the effluent chamber. There are many types of pump controls available which are suitable for this application. In selection of controls, it is imperative to select **CSA certified controls** which are capable of carrying the electrical current demanded by the pump.

PART 5 - SOILS TESTS AND WATER SOFTENERS

PERCOLATION TEST

The purpose of the percolation test is to obtain data that can be used to determine the length of weeping lateral in a disposal field required to handle the expected volume of sewage per day.

A percolation test which provides a rate of 5 to 10 min per 25 mm (per inch) would indicate a more course soil texture than a rate of l0 to 20 min per 25 mm (per inch) and therefore would be capable of accepting greater volumes of water or effluent in the same given area and period of time.

The rate at which a soil will accept water or septic tank effluent is dependent upon the size of the pore spaces between the individual soil particles. Sand particles, being much larger than either silt or clay particles provide large pore spaces and little restriction of the movement of water or effluent through the soil. Clays on the other hand have extremely small particles and accordingly, extremely small pore spaces between the particles, providing severe restriction of the movement of water or effluent.

A percolation test is subject to many factors that may influence the results obtained. Temperature, moisture in the soil, a large pore in the soil created by a dead plant root can provide an unrealistic representation of the soil texture, therefore, more than one percolation test should be taken on each disposal site.

A percolation test will only give an indication of the rate the soil will accept water. It gives no indication of possible changes in percolation rates caused by other factors such as the chemical elements found in the water supply serving the building.

A percolation test shall be conducted in the following manner:

(a) a minimum of 2 tests must be conducted at each sub surface effluent disposal site;

(b) a round hole to a depth of .9 m (3 feet.) must be excavated, carefully picking off the surface of the walls of the hole so no glazing or packing can affect the percolation of the water through the soil interface;

(c) the finished diameter of the test hole must be 200 mm (8 in);

(d) water shall be admitted to the hole slowly and carefully, so as not to disturb the soil, and:

(I) the bottom half of the test hole shall be saturated,

(ii) water shall be added until the rate of drop becomes constant,

(iii) the hole shall then be filled to .45 m (18 in.) and;

(iv) the rate of drop of the water in the test hole shall be determined and recorded in min/25 mm (min per in.) of drop.

SATURATION PERCENTAGE TEST

A very simple soils test called a "Saturation Percentage," may provide valuable information as to the pore sizes and particle sizes in relationship to the combination of sand, silt and clay in a soil sample taken from your proposed disposal site. Although the saturation percentage test may not be used for initial sizing, it may provide more accurate information relating to the long term operation of your disposal system.

The procedure for a Saturation Percentage test is:

(1) obtain a soil sample, preferably from the depth of the bottom of the disposal system,

(2) dry the sample completely. This can be done in an oven or can be left to dry naturally, time permitting.

(3) remove all rocks from the sample and grind the sample to break up as many large particles as possible into a fine, uniform sized mixture.

(4) accurately measure an amount (100 grams is adequate) of the dry sample. Be sure not to include the weight of the container in your 100 gram measure.

(5) add water slowly and carefully over a period of time, giving the sample time to absorb the water completely. Continue to add water until the sample is completely saturated and can absorb no more water.

(6) weigh the wet sample and subtract the weight of the dry sample from the weight of the wet sample. The difference in the weight, in relationship to the weight of the dry sample is the saturation percentage.

For example: the difference between a wet sample weighing 150 grams and a dry sample weighing 100 grams is 50 grams. Therefore the saturation percentage is 50% of the weight of the dry sample.

The higher the saturation percentage, the higher the percentage of smaller soil particles (silts and clays) and the greater the risk of disposal system failure.

Many types of clay shrink when dry and swell on wetting, further reducing pore size. The swelling and shrinking of soils that leave large cracks on the surface is particularly noticeable in soils containing large amounts of Montmorillonite clay. As a consequence, much larger absorption areas must be utilized for the same given amounts of effluent and time.

Montmorillonite clay is found throughout Alberta in varying amounts. It being the finest textured of all clays, it is also affected by chemical elements in the water supply and consequently the effluent.

A chemical water analysis of your proposed water supply may be the first indicator of probable sewage disposal problems, even before the installation of the sewage disposal system.

Sodium Absorbtion Ratio (SAR); This measurement is an indicator of the sodium hazard of a water. Excess sodium in relation to calcium and magnesium concentration in soils destroys soil structure reducing permeability of the soil to water and air.

Water with a high SAR (Sodium Adsorption Ratio), may be natural soft water, from a deep well, soft water produced by a water softener and waste water used in regenerating a water softener. These waters may be detrimental to a sub-soil effluent disposal system under certain circumstances. Generally the higher the SAR of the potable water, and the higher the saturation percentage of the soil, the greater the probability of sewage disposal failure.

SAR of the Potable water supply may be obtained from a chemical water analysis report. Some labs provide it as a routine item, others do not. If the SAR is not provided it may be calculated. It is important to realize that chemical water analysis reports usually provide information in ppm or mg/l, and **neither of these units of measurement may be used.** As there are three different elements used in the calculation, they must be converted into a common denominator in accordance with their atomic weights. This common denominator is referred to as me/l, and may be obtained by dividing sodium by 23, calcium by 20 and magnesium by 12. The numbers obtained from these three calculations may then be applied to the formula:

$$SAR = \frac{Na}{\frac{Ca + Mg}{2}}$$

Cations are expressed in me/l

If the SAR of the potable water supply is greater than 4, it is highly recommended that a saturation test be done. If you multiply the SAR of the potable water by the saturation percentage of the soil and the product does not exceed 1200-1500, future problems are not expected under normal design usage. A reduction of efficiency and possible failure could be expected if the product is in the range of 1500-2200. A larger field may extend the useful life of the disposal system. Products in excess of 2200 should be considered for very short term use and in excess of 2500-3000, a disposal field should not be installed.

Note: These tests at this time have no direct relationship with the Percolation Test. A percolation test will still be required to size a disposal field.

WATER SOFTENERS

The use of a water softener in conjunction with a sub-soil effluent disposal system is not recommended as it will increase the SAR of the waste water entering the septic tank. If a water softener must be used, avoid the installation of water softeners that automatically backwash at preset intervals of time. This type of unit may discharge unneeded concentrations of salt into the disposal system.

If a water softener must be used, "Sensing" or Metering" type water softeners are preferred. These water softeners only backwash or regenerate when hardness of the water is sensed or after a preset volume of water has been used, thereby reducing the total volume of salts discharged into the disposal system.

Under no circumstances should any water softener be used for iron removal. If iron removal is required, the use of a proper iron filter should be employed.

PART 6 - THE DISPOSAL OF EFFLUENT

CLEARANCES

Boundaries and property lines, buildings, wells and other water sources, are a major consideration in laying out a disposal system. **Refer to the Code for acceptable minimum clearance requirements for your proposed system.**

EFFLUENT - METHODS OF DISPOSAL

The liquid portion of the sewage which passes through the septic tank is known as effluent. The treatment and disposal of effluent may be accomplished by one of the following methods outlined in **Part 7, 8, 9, and 10**, depending on the percolation rates, soil conditions and water table.

PART 7 - DISPOSAL FIELDS

DISPOSAL FIELDS - GENERAL (Subsurface and Raised disposal fields)

The proper sizes for disposal fields for single family dwellings and duplexes may be found in the tables in the Code.

For other than single family dwellings, use the tables found in the Code to obtain the expected volume of sewage per day and one of the following formulas:

$$m = \frac{L \times P}{133}$$

where m = length in meters
L = Litres per day expected volume of sewage
P = percolation time in minutes per 25 mm

$$F = \frac{G \times P}{9}$$

where F = length in feet
G = gallons per day expected volume of sewage
P = percolation time in minutes per inch

Septic tank effluent contains minute particles of sewage, or suspended solids, and bacteria. When the effluent is percolated into the ground, these impurities are attacked by myriad biological organisms naturally present in the soil. These organisms utilize the organic materials as food and thus oxidize them into safe and stable compounds.

The biological organisms which perform this function are **"aerobic,"** meaning they require the presence of available oxygen for life. Their natural habitat, therefore, is the surface and upper layers of the soil. This is why lighter soils and comparatively shallow disposal fields are the most efficient for effluent disposal and why weeping laterals are not to be laid in excess of .6 m (2 feet) below the surface.

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The intermittent flushing of disposal fields or mounds, the rest period required between flushes, the air space in disposal field trenches or the gravel bed in a mound, and the use of more weeping lateral in a disposal field than is necessary to hold the effluent, all help in keeping the disposal system **"Aerobic."**

If an effluent disposal system is too small and permitted to become constantly saturated, the oxygen is driven out of the soil, the aerobic organisms die. The system than becomes anaerobic, inefficient, a danger to health and ultimately will fail. For this reason, longer rest periods are provided between flushes into disposal fields installed in heavier soils to maintain aerobic conditions.

Chart 1 (See Page 35) indicates the difference in the minimum lengths of weeping lateral required per 450 litres (100 gallons) of effluent per day at various percolation rates of the soil between "Aerobic" and "Anaerobic" installations.

WEEPING LATERALS

Although the Code requires a minimum separation of 1.5 m (5 feet) spacing between weeping laterals, a distance of 3 m (10 feet) is recommended for ease of installation.

Trenches for weeping laterals must be .45 m (18 in.) minimum width. The total length of weeping lateral required may not be reduced by using trenches wider than .45 m (18 in.). The weeping lateral (perforated pipe) must be laid within .6 m (24 in.) from the ground surface.

Obtain the total length of weeping lateral required from:

(a) The table found in the Code for single family dwellings or duplexes, or;

(b) By using a formula found in the Code for other than single family dwellings. Refer to the tables to determine the expected volume of sewage per day.

Use the full amount of weeping lateral indicated. An under sized disposal field will soon become overloaded, effluent may seep out, and it is more likely to freeze.

Each weeping lateral throughout its entire length, and the trench bottom should be nominally level. The top of the trench (ground surface) can vary as long as the cover over the weeping lateral stays within the .6 m (24 in.) maximum depth.

The weeping lateral shall be bedded in gravel. The top of the gravel should be even with the top of the weeping lateral (perforated pipe). This provides support for the piping and prevents it from becoming oval shaped or broken due to the weight of the soil above or, in the event that vehicles are driven over the trenches. The installation of gravel higher than this is not recommended.

The top 150 mm (6 inches) of gravel must be clean, coarse gravel of a particle size 15 mm to 40 mm (1/2 in. to 1 1/2 in.). The lower 150 mm (6 inches) of gravel may be substituted with clean sand. The sand should not contain any silt or clay.

Gravel is necessary for these reasons:

(a) It allows effluent to escape freely from the weeping lateral so it cannot freeze.

(b) It provides air space in the trenches for the aerobic bacteria which are necessary to treat the effluent and prevent the suspended solids in the effluent from plugging the pore spaces of the soil.

(c) If weeping laterals (perforated pipe) are laid directly in soil, the perforations soon plug and the effluent cannot escape. Gravel keeps the escape holes open, .3 m (12 in) of gravel is preferred.

Cover the clean gravel with any kind of straw (except Flax straw) to prevent the backfill soil from filling the air spaces in the gravel.

Backfill in the weeping lateral trenches must not be compacted. Do not pack the backfill or run vehicles over it. Allow 50 mm to 75 mm (2 or 3 in.) of excess backfill to make up for settling, and allow the backfill to settle naturally.

LOCATION OF DISPOSAL FIELDS

Avoid hard packed yards, driveways, paths, etc. If the effluent sewer must cross under such a bare spot, use a frost box. **See Fig. Frost 1 (Page 25).**

The disposal field should be constructed on elevated, well drained ground. The disposal field must not be constructed in low areas which may be subject to flooding or where a seasonally saturated layer is evident below the trench bottom, within a vertical distance of 1m (3 feet) or 1.5m (5 feet) from an impervious layer of rock or water table. The drainage of the disposal area should be away from the source of domestic water supply.

A sloping, sheltered, well drained, sunny location where the snow piles deep in winter and the grass is well kept in summer is ideal. Do not allow growth to shade the ground surface.

LEVEL GROUND SYSTEMS

In level areas, using a siphon type septic tank, there is often a problem in keeping the disposal field at a shallow .3 m to .6 m (12 to 24 in.) depth. The loss in elevation within a septic tank with siphon requires the building drain and inlet to the septic tank to be above ground. **See Fig. Tanks 2 (Page 27).**

A level ground disposal field differs from a sloping ground disposal field in that:

(a) fittings such as (Y's), (T's), (TY's), or "crosses" may be used to inter-connect all field headers and weeping laterals, and;

(b) all perforated piping must be at the same level, and;

(c) all weeping lateral trench bottoms must be at the same level.

SLOPING GROUND SYSTEMS USING FITTINGS

Where it is necessary to locate a disposal field on a sloping area, special precautions must be taken to see that all laterals are equally supplied with effluent and installed at the proper depth. This can be accomplished by the methods shown in **Figs. DF 5, through DF 8 (Pages 38 & 39).**

It is of great importance to note that in all sloping ground systems that each weeping lateral is installed level, but at a different elevation. **Figures DF 5, DF 6, and DF 7 (Page 38)** show each installation has three laterals, each connected to the other by means of a solid pipe. Each weeping lateral trench is deeper than the trench for the solid pipe.

Use gravel only under the weeping laterals. If gravel is used under the solid piping, the effluent may follow the gravel down the hill side.

It is a good practice when connecting the weeping lateral to the solid pipe to use a combination of fittings to raise the inlet end of the solid piping slightly. This will ensure that the weeping lateral has discharged some effluent into it's trench prior to conducting the remainder of the effluent to the solid pipe, and on to the next lateral, and so on.

SLOPING GROUND SYSTEMS USING DROP BOXES

Fig. DF 8 (Page 39) uses a drop box instead of fittings to supply the weeping laterals with effluent from the distribution header. Drop boxes are simply a container with holes cut in it for the inlet, outlet, and the weeping lateral(s). A 20 litre (5 gal.) plastic pail, complete with lid, may be utilized as a suitable drop box. The holes cut in the drop box should fit the piping tightly and should be sealed water-tight around the piping. The ends of the weeping laterals should also extend into the drop box far enough to be capped off. Periodic capping allows the weeping lateral(s) to be given a rest period by forcing the effluent to overflow to the next drop box and lateral(s). The lid of the plastic container provides access for capping the weeping lateral(s), and a method of monitoring the condition of the disposal field. Proper marking of the location and protection of the drop box lid is required.

SLOPING GROUND SYSTEMS USING BI-LEVEL CROSSES
(See Figs. DF 10 and Fig. DF 11 (Pages 40 & 41).

Note: This method is not recommended for installation on slopes exceeding 10% (10 vertical to 100 horizontal) grade .

Disposal fields using Bi-level crosses should have the effluent sewer and distribution header running straight down the hill. The distribution header is located higher than the weeping laterals and each lateral is distributed with effluent in succession. The weeping laterals which connect under it, are at right angles and are level. Holes should be carefully measured and cut in the bottom of the distribution header, according to the number of weeping laterals which cross under it and are fed by it. The trenches for the weeping laterals may bend around a hill like a level irrigation ditch."

On Bi-level cross systems, no gravel should be used under the main distribution header as it may cause the system to fail. Gravel should only be under the weeping laterals. In this way the effluent is held on the hill side for treatment, and evaporation.

When using bi-level crosses in a field, it is essential that the holes in the distribution header are sized carefully. If the holes are too small, too much effluent may pass the first weeping laterals and overload the bottom laterals. If the holes are too large, only the first weeping laterals will be supplied with effluent.

A holding tank for overloads and emergency pumping may be recommended for the end of the distribution header in some applications. In the event the weeping laterals become loaded or frozen, the excess effluent has clear passage through the elevated header to the holding tank. This system has proven very successful in systems which may be subject to occasional short term overloads, or to supplement a disposal field where there is not room to install the sufficient length of weeping lateral.

SPLIT DISPOSAL FIELDS

Split fields are advantageous in areas with soils that have a high saturation percentage (high percentages of clay or expansive clays), as these soils may be expected to have reduced percolation rates after being in use for a period of time.

Another advantage of the split field system is that two smaller disposal fields may be installed in two smaller areas separated from each other. For example, one disposal field in the front of the house and the other in the back yard. This can be a viable alternative in situations where there is not sufficient room in one area to install the total length of weeping lateral required, or a way to add on to an existing disposal field which has failed. In this case, the new disposal field would be half the size of the total length of weeping lateral required. The old disposal field could then be rested and may work again as an alternative field.

This system takes the total required footage of weeping laterals required and splits it into two (or more) separate disposal fields. The minimum size of each disposal field when using the split field method should not be less than 60 m (200 feet) of weeping lateral.

The use of a diverter (a small manhole in which the unused outlet is plugged), allows the owner to switch the flow of effluent from one field to the other. This provides a rest period where a saturated or inefficient field may dry out and regenerate it's self.

The resting period should be 6 months to a year. Such a rest will change an anaerobic, saturated, clogged soil back to it's original aerobic, pervious condition. The same surface area, using a split field system, will be several times more efficient than a single field which never has the opportunity to become refreshed.

As a field is halved, so also is the volume per flush halved. This may avoid the need for larger and/or separate effluent chambers and result in a considerable saving in cost.

e.g. 340 litres (75 gallons) per flush is adequate for 60 m to 90 m (200 to 300 feet) of weeping lateral.

a minimum of 454 litres (100 gallons) flush is required for 120 m (400 feet) of field.

A minimum size septic tank for a three bedroom house would have a working capacity in the first compartment of 1800 litres (400 gallons) and an effluent chamber capable of discharging 340 litres (75 gallons). This could not be used if the tables in the Code require more than 90 m (300 feet) of weeping

lateral. However, using the split field system, a minimum sized septic tank and effluent chamber could serve two 90 m (300 foot) disposal fields, or a total of 180 m (600 feet) of weeping lateral.

Larger split fields may be installed as shown in **Fig. DF 14 (Page 44).** In this case several trickle septic tanks have been installed in series to provide the working capacity as required in accordance with the expected volume of sewage per day. The last tank in the series is used as an effluent chamber in which a pump must be installed.

The split field system should always be considered as the first choice.

RAISED DISPOSAL FIELDS

Raised disposal fields may be installed where a seasonally saturated layer or water table is too close to the ground surface to permit the installation of a normal system. This system is installed by hauling sufficient fill material to provide the minimum vertical distance from the bottom of the trench to the seasonally saturated layer or water table. When considering this method, it is a good practice to haul in the fill material and let it settle naturally over winter before proceeding with the installation of the system. This will help to avoid settling and landscaping problems after the installation is made. Grass cover should be established as soon as possible after the installation is completed. All normal installation requirements for disposal fields apply.

PART 8 - TREATMENT MOUNDS

TREATMENT MOUNDS

If the soil percolation rate is either too fast or too slow or a seasonally saturated soil or water table exists closer than 1 m (3 feet) from the surface, constructing a treatment mound may be an alternative to a disposal field.

Mound construction begins with the excavation of 1.5 m (5 feet) deep test holes to establish the presence of an impermeable layer or soil mottling. Soil mottling would indicate a seasonally saturated layer caused by a fluctuating water table. **Soil mottling is a zone of chemical oxidation and reduction activity, appearing as splotchy patches or red, brown, orange and grey in the soil.**

A vertical separation of at least 1 m (3 feet) is required between the bottom of the gravel bed and any restricting layer or seasonally saturated layer in order to maintain aerobic conditions in the sand or fill material under the gravel bed.

Soils with a "hardpan" layer or bedrock, restrict the downward movement of the liquids. When impermeable bedrock is present, the vertical separation distance must be increased to, at least 1.5 m (5 feet).

A properly constructed mound should be placed on at least .6 m (24 inches) of natural soil which is not seasonally saturated. If this is not possible, suitable fill material must be imported to provide the minimum .6 m (24 inch) vertical distance between the bottom of the sand layer and the seasonally saturated layer or hard pan layer.

Proper construction practices for mounds are extremely important.

Once the location has been found to be suitable, the installation of the effluent line from the septic tank to the mound area may be installed. Prior to the actual installation of the effluent line, the installer must know the pump capacity and head pressure, the distance from the septic tank to the mound and the friction loss throughout the piping to enable him to size the effluent line to provide adequate pressure in the laterals for proper distribution of effluent. **See Table 8.6 B of the Code.**

The trench for the effluent line should extend only under the edge of where the base of the completed mound will be and must be carefully backfilled and compacted to prevent settling of the mound into the trench.

CONSTRUCTION OF TREATMENT MOUNDS

Please refer to the Code for specific details on the construction of treatment mounds.

CONSTRUCTION OF LATERALS

Laterals within the mound must be custom made for each individual installation. Laterals are usually manufactured from Schedule 40 PVC pressure piping. **See Figs. M2, M3 and M4 (Pages 47, & 48).** The diameter and length of the lateral as well as the maximum number, size and spacing of perforations must be carefully calculated. **See Table 8.6 C of the Code.**

The number and size of perforations must match the rate of discharge from the pump at a given head pressure in order to maintain a minimum head pressure throughout the distribution system. **See Table D.** The perforations must be drilled straight into the bottom of the laterals to ensure complete drainage. Perforations may also be drilled in the lower half of the face of the caps on the ends of the laterals.

PART 9 - OPEN DISCHARGE

OPEN DISCHARGE

Due care and consideration must be exercised when proposing this type of system. Open discharge systems are simply a means whereby effluent from the septic tank is discharged directly onto the ground surface.

Although an open discharge system may be one of the most economical methods of treatment and disposal of effluent, it is also the least desirable. This type of system is not intended for use in residential subdivisions and should only be considered for use in rural areas where close proximity to neighbours, water supplies and property lines can be avoided. Health, environmental and nuisance concerns often become a major issue with this type of system. It is strongly recommended that the area wetted by the open discharge system be fenced to keep animals and children away.

There are several methods of open discharge, as shown in **Fig. OD 1, OD 2 & OD 3 (Pages 52 & 53),** depending on the slope of the land, size of the effluent chamber and the depth of bury of the septic tank.

Fig. OD 1 (Page 52) indicates a shallow bury septic tank with a small effluent chamber. Care must be taken to ensure the effluent line is installed below frost level as, the effluent line always contains effluent. The riser should be far enough above ground level to have sufficient head to cause the effluent to drain from the riser, to below frost level when the pump shuts off. The mound around the riser provides support for the riser, as well as some frost protection. The mound should be covered with large gravel or field stone to prevent erosion from falling effluent.

Fig. OD 2 (Page 53) indicates a deeper buried septic tank with a larger effluent chamber. In this case, all the effluent is intended to drain from the effluent line back to the septic tank to prevent the effluent line from freezing. It is necessary to install this effluent line without dips or sags which may trap pockets of effluent which may freeze and obstruct the line in cold weather. The outlet end of the effluent line should be extended at least .3 m (1 foot) above ground level to prevent the outlet from being covered with ice in freezing weather and the outlet area should be protected with large gravel or field stone to prevent erosion and possible pooling of effluent in the area.

Fig. OD 3 (Page 53) indicates the use of a siphon type septic tank when sloping ground conditions are favourable. Here again, the outlet should be extended above ground level and the area where the effluent falls must be protected from erosion. A siphon type septic tank is capable of discharging in excess of 90 L (20 gallons) per minute and severe erosion may occur if not prevented. Care must be taken to ensure there is no air circulation through the septic tank in winter months, in order to prevent freezing of the septic tank.

Open discharge should only be considered when all other forms of treatment and disposal are not feasible.

PART 10 - SEWAGE LAGOONS

SEWAGE LAGOONS

Although septic tanks followed by some form of effluent treatment and disposal system are the most commonly used method for disposal of sewage from domestic residences, residences and larger installations may consider the use of a sewage lagoon.

Lagoons are recommended particularly in areas where heavy clay subsoils (especially clay soils containing amounts of montmorillonite clay) and/or high SAR potable water supplies would make the use of a subsurface effluent disposal system unreliable.

Sewage piped to a lagoon may pass through a septic tank or may flow directly to a lagoon with no treatment. Sewage is retained for a minimum period of one year. The detention of the sewage for this period of time permits disease producing bacteria to die off. The combined actions of oxygen from the atmosphere, bacteria, and algae accomplish the treatment of sewage in lagoons.

The design of a sewage lagoon is such that it has a level, flat bottom and a maximum liquid depth of 1.5 m (5 feet) with .6 m (2 feet) of freeboard above the maximum liquid depth to the top of the berm.
The table in the Code gives recommended sizes.

Lagoon berms and bottoms must be constructed of compacted clay or lined so that seepage is minimized. Berms are to have a 1.8 m (6 foot) top width and slopes of three horizontal to one vertical. **Fig L1 (Page 55),** shows details of lagoon construction.

The gradual slope of the inside of the lagoon is very important for operational and safety reasons:

(1) The large liquid surface area created by this slope allows for increased absorption of oxygen from the atmosphere for more efficient stabilization of the sewage.

(2) The large liquid surface area allows increased evaporation of the sewage, reducing the amount of liquid stored and increasing the efficiency of the lagoon. (a properly sized lagoon is one in which the liquid level rises through the winter months and falls through the summer months).

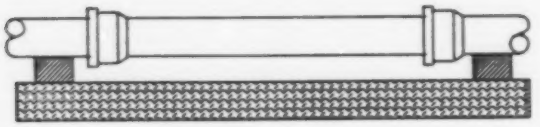
(3) When ice forms in the winter months, the ice expands and floats on the surface of the liquid, rising with the increasing liquid depth. In lagoons which have steep side slopes, the ice has been known to dig into the sides, effectively "capping" the lagoon, preventing any further entry of liquids. This causes the sewage to back up into the house similar to a plugged sewer, and may also result in a frozen building sewer. A hole cut in the ice will allow the liquid to overflow on to the top of the ice and drain the building sewer.

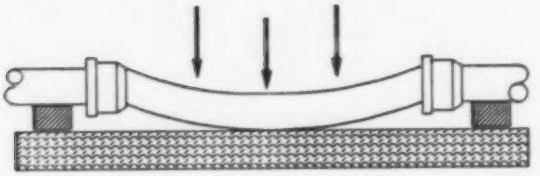
(4) In the event that a person or animal should for any reason fall into a lagoon, the gradual side slopes will allow that person or animal to crawl out to safety.

The operation of a lagoon requires regular inspection, and control of grass and weed growth on the berms. Surface run off is to be diverted around the lagoon.

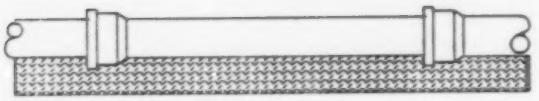
Fencing of lagoons is recommended, and under certain circumstances is required.**(Check the Code).**

Support Of Underground Piping





An improperly supported underground pipe will sag and settle until it reaches a firm base. Plastic piping may bend and cause traps which trap water and may be subject to freezing or clogging. All piping if not properly supported is subject to breakage.



Properly supported underground piping should be laid with the barrel of the pipe evenly and continuously supported on a bed of undisturbed earth or tightly compacted earth.

Fig. Pipe 1

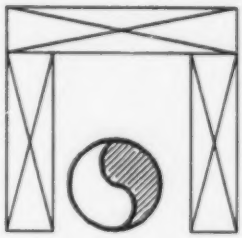
Frost Protection

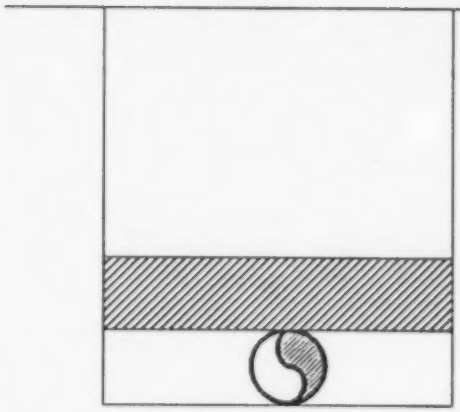
Less Than 1200 mm (4 feet) of Earth Cover

250 mm (10 inch.)
Galvanized steel,
Concrete, Plastic,,
Clay Tile, etc.

Pressure Treated Planks
2 x 10 minimum

100 mm (4 inch)
min. air space
above pipe
inside
Frost Box





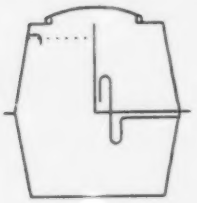
Backfilled trench with 100 mm
(4 inch) layer of Styrofoam
installed over the piping.
Styrofoam should be the full
width of the trench.

Other methods of frost protection may also be suitable.

Fig. Frost 1

Septic Tanks

Double compartment septic tank with siphon



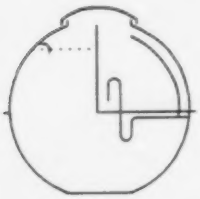
Basic shapes of septic tanks;

(a) Cylindrical, may be horizintal or vertical;

(b) Spherical,

(c) Retangular.

Double compartment septic tank with siphon



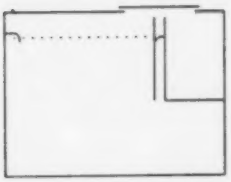
Basic Types of Septic Tanks:

(a) Single compartment "Trickle Tanks",

(b) Double Compartment "Siphon Tanks",

(c) Double compartment "Pump Tanks".

Double compartment septic tank with pump



Basic septic tank materials;

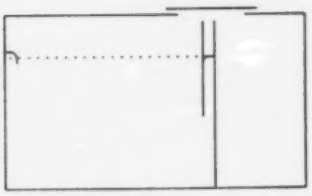
(a) Concrete

(b) Fiberglass

(c) Polyethylene

(d) Steel (rarely used)

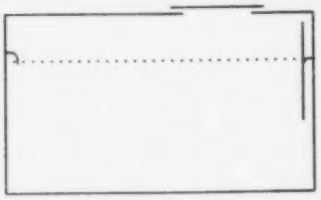
Double compartment septic tank with pump



Minimum Size of septic tank is 1800 L (400 gallons) "Working Capacity". The working capacity is the volume of the first compartment only and does not include the volume of the effluent chamber.

Common sizes vary between 1800 L to 4500 L (400 to 1000 gallons) working capacity, with larger sizes made to order as required.

Single compartment "Trickle Tank".



Single compartment "Trickle Tanks" may not be used alone, but may be installed in series with other septic tanks to increase the volume of the working capacity as required. The last tank in a series of tanks may be used as a large effluent chamber to match the volume per flush to a large field.

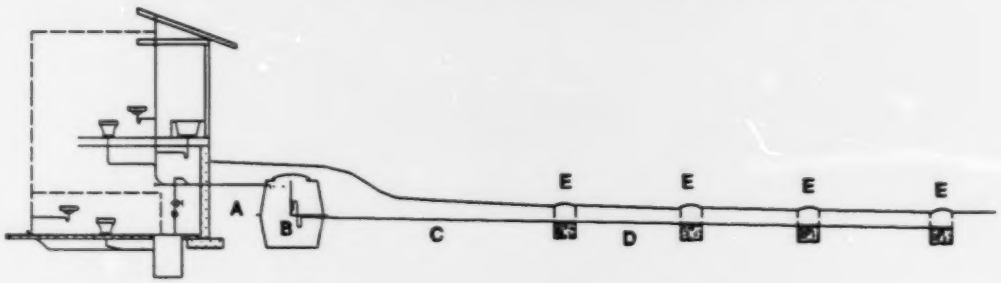
Fig. Tanks 1

Elevations For Syphon Type Septic Tanks

Perforated piping for weeping laterals may be laid not shallower than 300 mm (12 inches), or not deeper than 600 mm (24 inches) measured from the ground surface to the top of the pipe.

Locate the septic tank a minimum of 1 m (3 feet) from the building.

Set the outlet of the septic tank to provide the correct depth of the weeping laterals, allowing for grade on the effluent sewer and the distribution header .
The inlet of the septic tank will then determine the elevation of the building drain.



(A) The building drain may be 3 inch DWV provided it has a minimum grade of 2% (1/4 inch per foot).

(B) Siphon type septic tank.

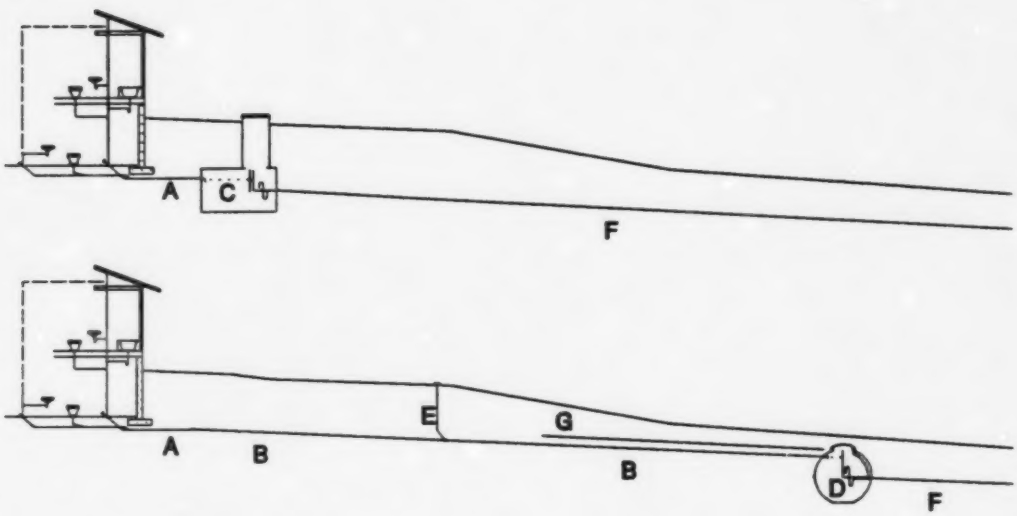
(C) Effluent Sewer. Any Plastic piping connected to a septic tank or sewage holding tank shall not be lighter than D.W.V. to a point at least 2m (6 feet) from the tank.

(D) Distribution header. This piping must be graded and laid with the barrel of the pipe evenly and continuously supported on a bed of undisturbed earth or compacted earth between the weeping lateral trenches.

(E) Weeping laterals.

Fig. Tanks 2

Deep Or Remote Septic Tanks



(A) Building drain leaving the house, connects to either the septic tank or the building sewer.

(B) Building sewer connecting the building drain to the septic tank.

(C) Deep septic tank, complete with access opening extension.

(D) Remote septic tank installed where the building sewer intercepts the hillside.

(E) Extended "y" cleanout installed at intervals not exceeding 25 m (85 feet).

(F) Effluent sewer from septic tank to effluent disposal system.

(G) Frost protection for the portion of the building sewer that does not have 1200 mm (4 feet) of earth cover. (See Fig.Frost 1.)

Fig. Tanks 3

Excavations For Septic Tanks And Sewage Holding Tanks

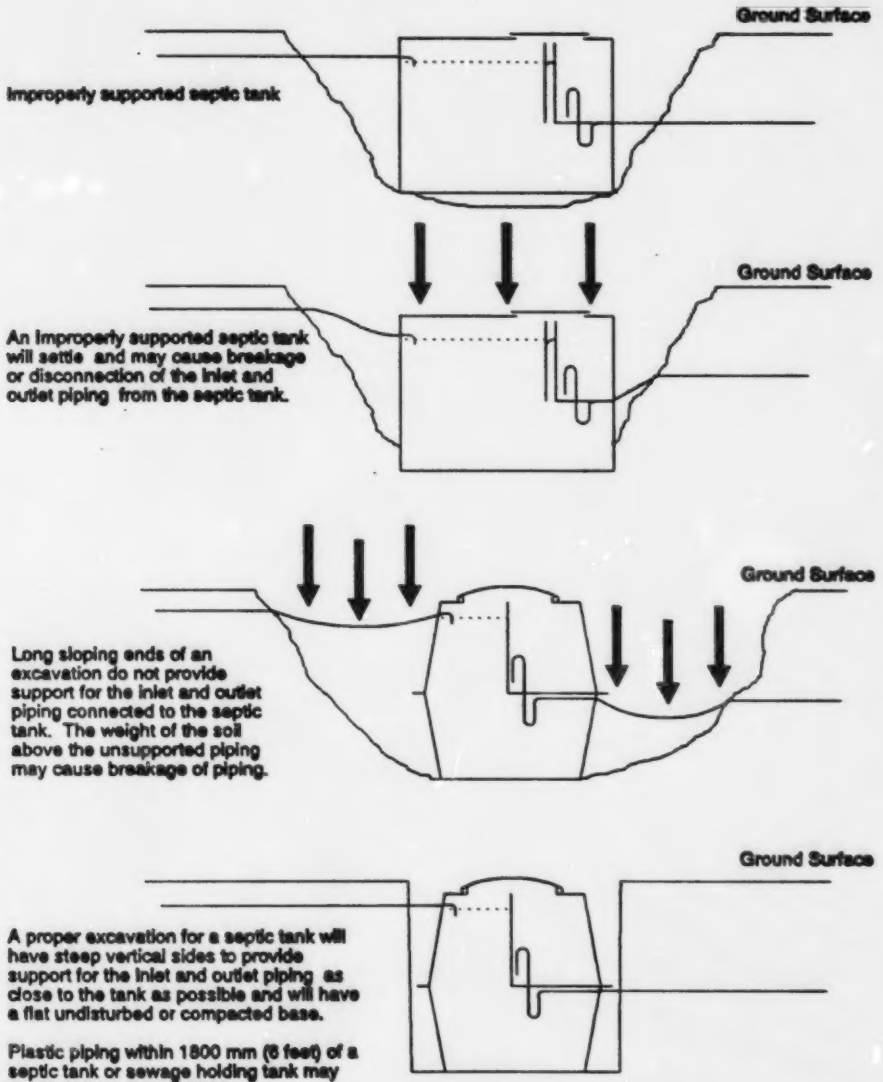
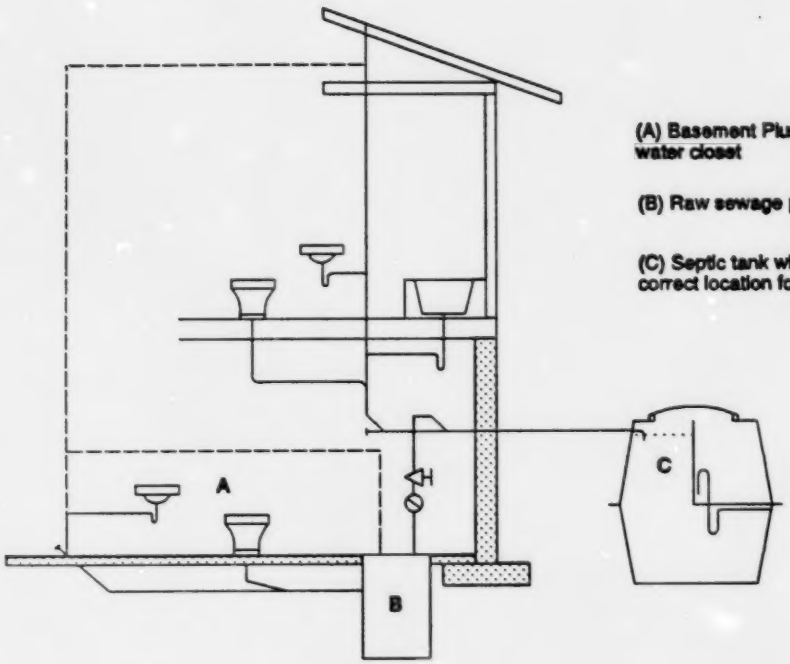

Ground Surface
Improperly supported septic tank
Ground Surface
An improperly supported septic tank will settle and may cause breakage or disconnection of the inlet and outlet piping from the septic tank.
Ground Surface
Long sloping ends of an excavation do not provide support for the inlet and outlet piping connected to the septic tank. The weight of the soil above the unsupported piping may cause breakage of piping.
Ground Surface
A proper excavation for a septic tank will have steep vertical sides to provide support for the inlet and outlet piping as close to the tank as possible and will have a flat undisturbed or compacted base.
Plastic piping within 1800 mm (6 feet) of a septic tank or sewage holding tank may not be lighter than D.W.V.

Fig. Tanks 4

Raw Sewage Lift Pump



(A) Basement Plumbing including a water closet

(B) Raw sewage package Lift Pump.

(C) Septic tank with siphon set at the correct location for a disposal field.

Fig. Pumps 1

Effluent Pumping With Submersible Effluent Pump

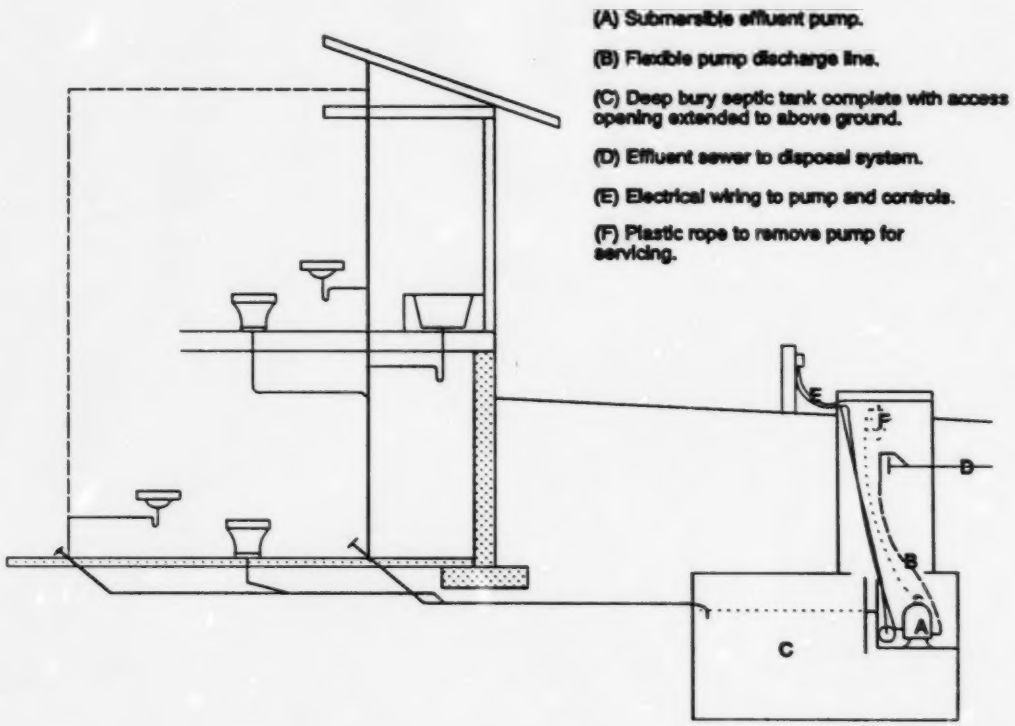

(A) Submersible effluent pump.
(B) Flexible pump discharge line.
(C) Deep bury septic tank complete with access opening extended to above ground.
(D) Effluent sewer to disposal system.
(E) Electrical wiring to pump and controls.
(F) Plastic rope to remove pump for servicing.
E
F
D
B
A
C

Fig. Pumps 2

Effluent Pumping

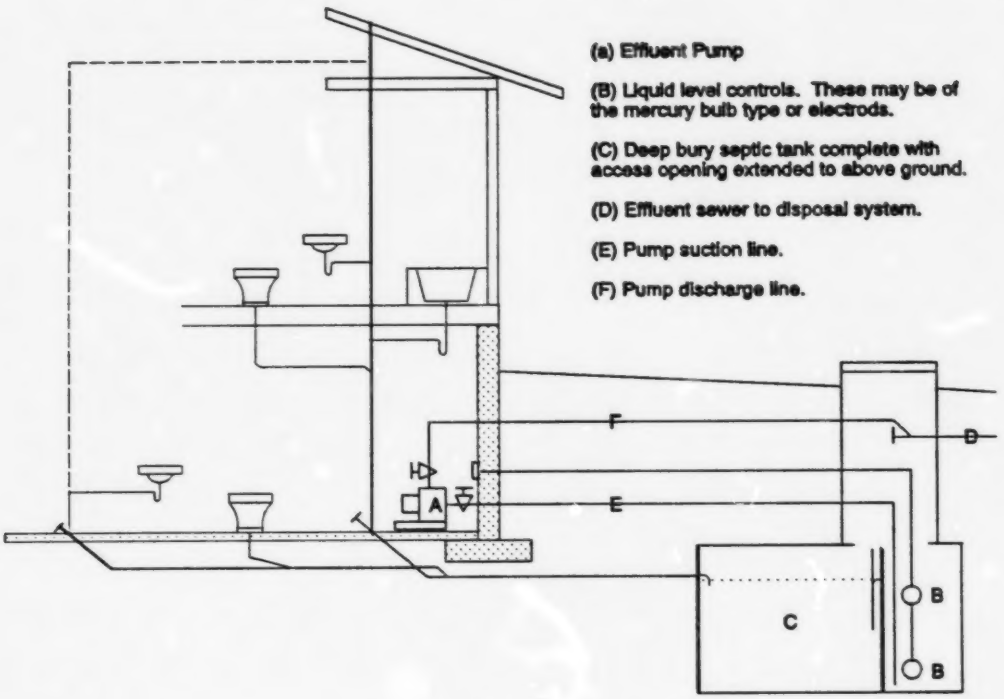


Fig. Pumps 3

Disposal Field Installation
Using A Deep Bury Pump Type Septic Tank
N.T.S.

(Other designs may also be acceptable)

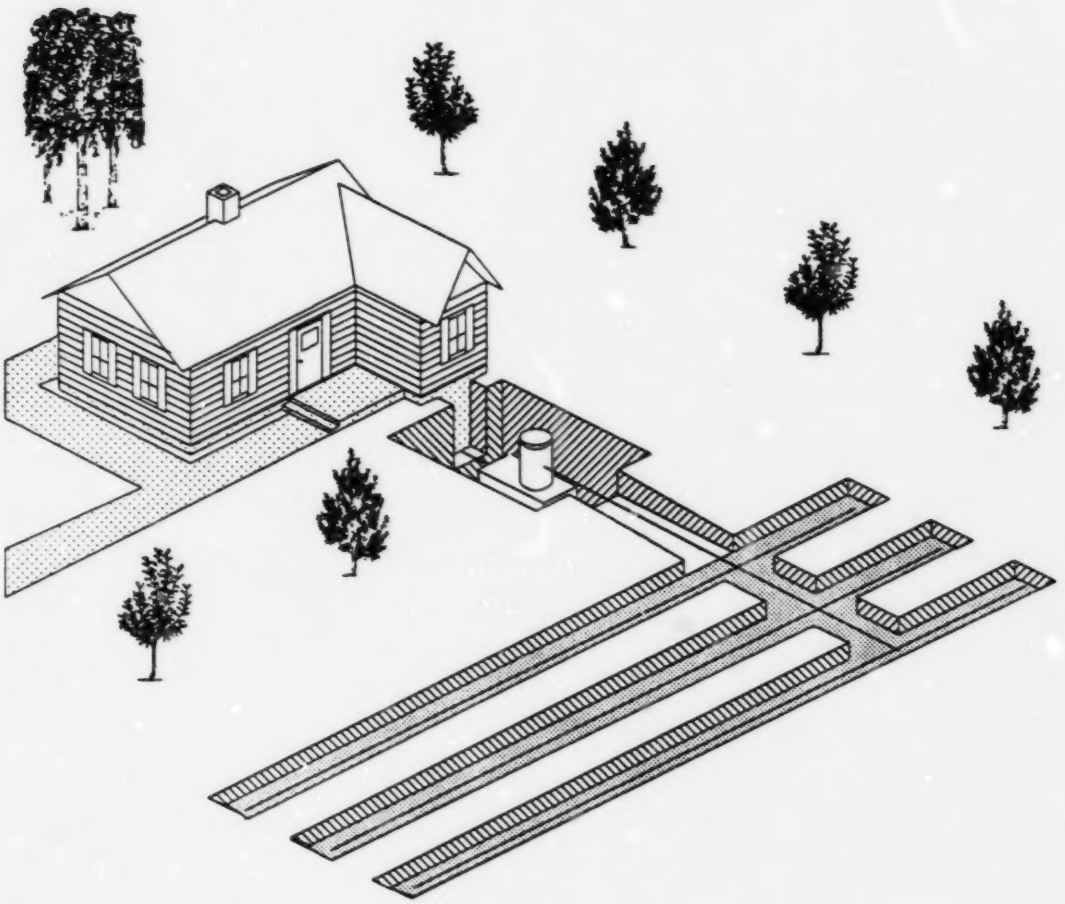


Fig.Typical 1

Disposal Field Installation Using
A Shallow Bury Siphon Type Septic Tank
N.T.S.

(Other designs may also be acceptable)

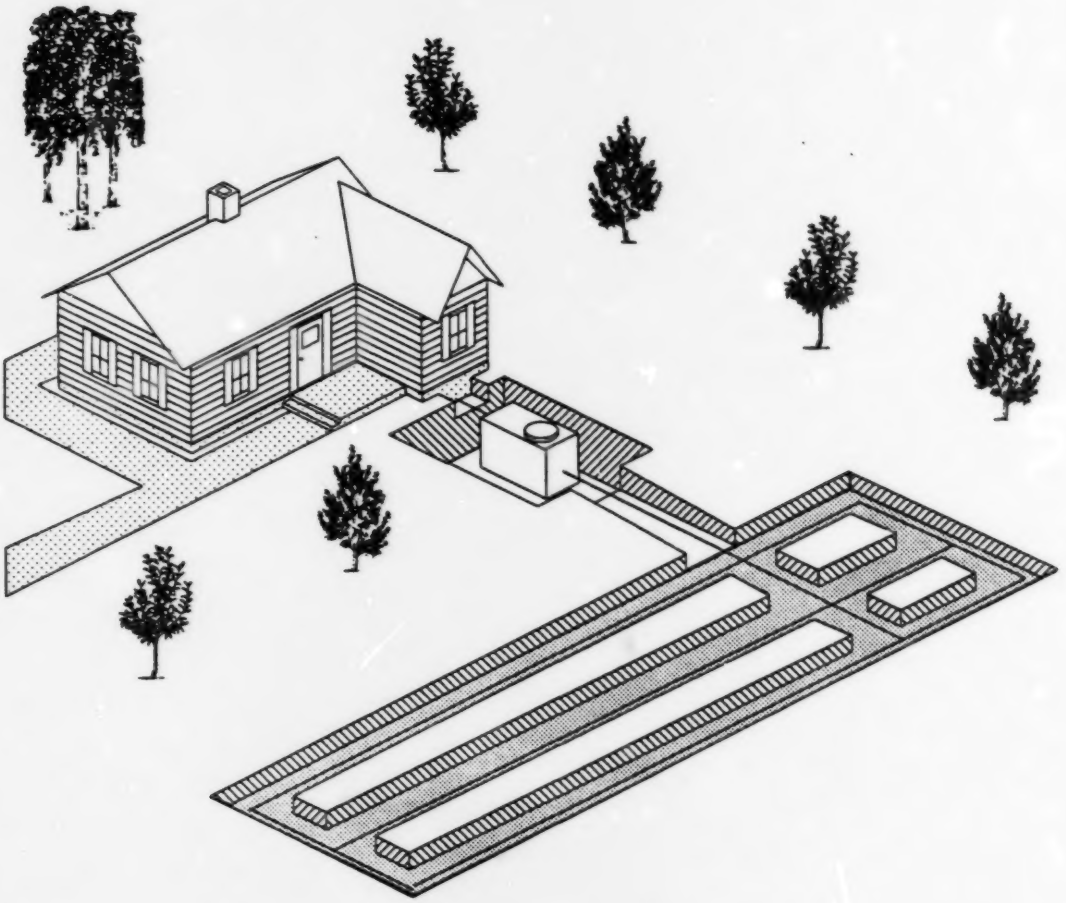
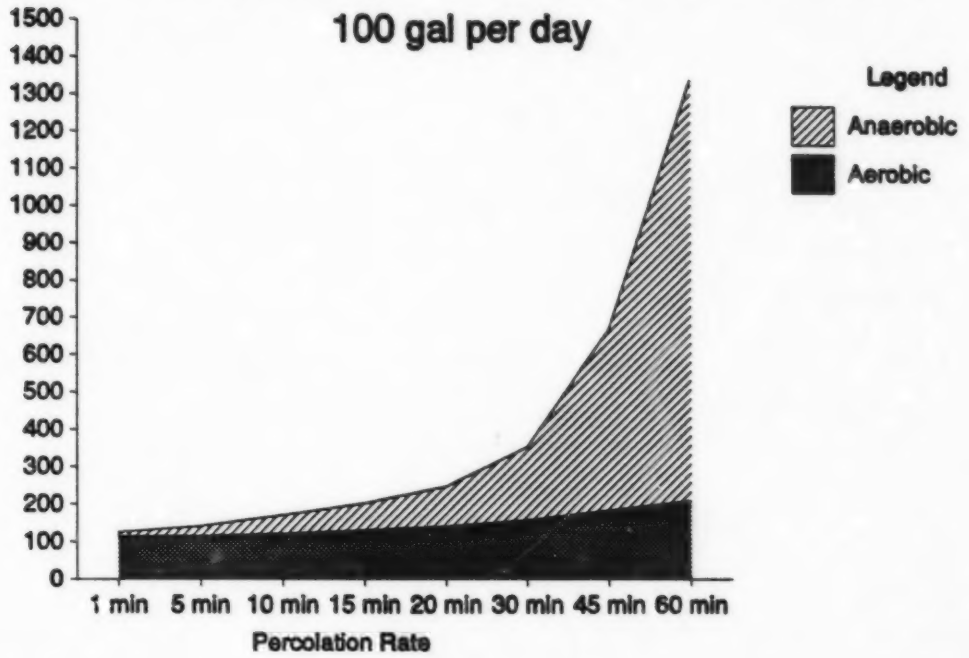


Fig.Typical 2

Comparison In Length of Weeping Lateral Required For Aerobic and Anaerobic Disposal Fields At Various Percolation Rates of The Soil



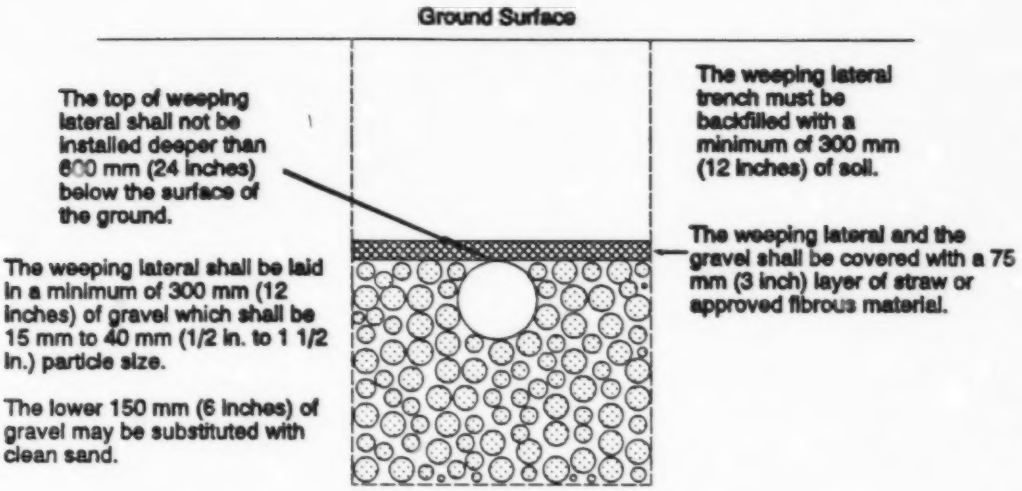
Information obtained from:

Treatment And Disposal Of Waste Water From Homes By Soil Infiltration And Evapo-transpiration.

Alfred P. Bernhart 1973

Chart 1

Weeping Lateral


Ground Surface
The top of weeping lateral shall not be installed deeper than 600 mm (24 inches) below the surface of the ground.
The weeping lateral shall be laid in a minimum of 300 mm (12 inches) of gravel which shall be 15 mm to 40 mm (1/2 in. to 1 1/2 in.) particle size.
The lower 150 mm (6 inches) of gravel may be substituted with clean sand.
The weeping lateral trench must be backfilled with a minimum of 300 mm (12 inches) of soil.
The weeping lateral and the gravel shall be covered with a 75 mm (3 inch) layer of straw or approved fibrous material.

The weeping lateral trench shall be a minimum width of 450 mm (18 inches) and a maximum width of 760 mm (30 inches) and shall have a nominally level bottom.

Gravel Required

Depth of Gravel	Trench Width	Cubic Meters (Yards) of Gravel per Meter (Foot) of Weeping Lateral
150 mm (6 inches)	450 mm (18 inches)	0.0675m3 (0.028)
300 mm (12 inches)	450 mm (18 inches)	0.135m3 (0.056)
150 mm (6 inches)	600 mm (24 inches)	0.09m3 (0.037)
300 mm (12 inches)	600 mm (24 inches)	0.18m3 (0.074)

Fig. DF 1

Disposal Fields For Level Areas

(Other designs may also be acceptable)

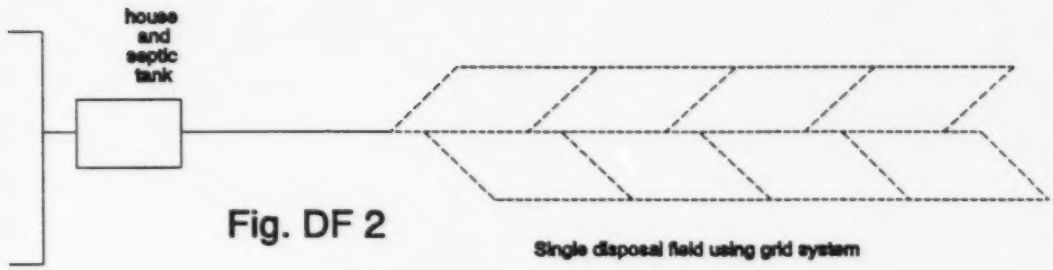
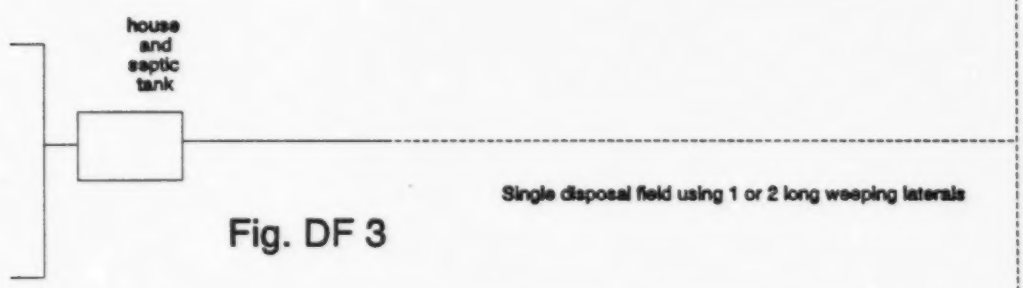


Fig. DF 2

Single disposal field using grid system



Single disposal field using 1 or 2 long weeping laterals

Fig. DF 3

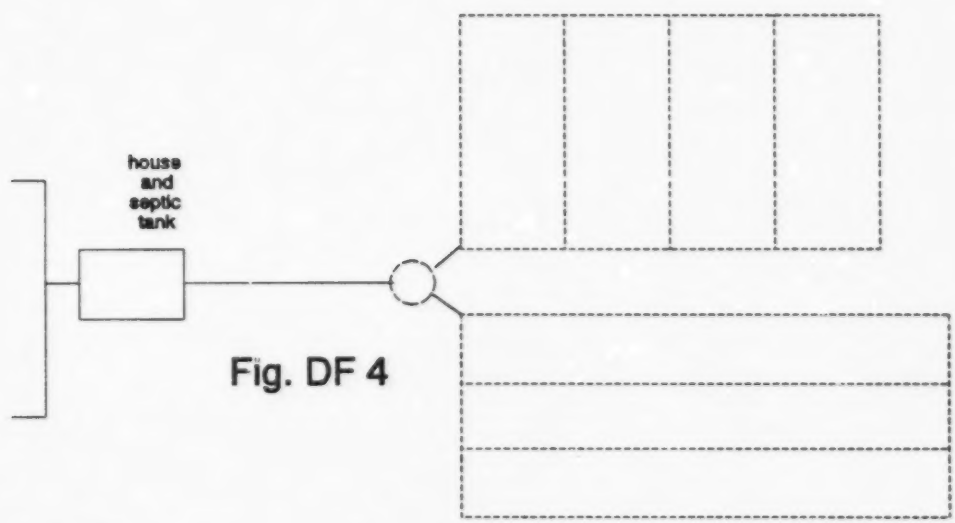


Fig. DF 4

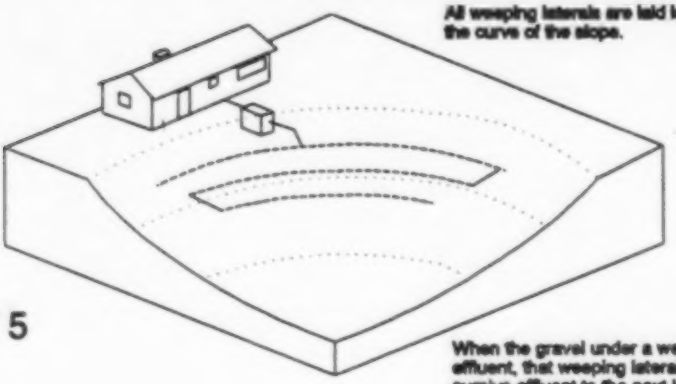
Solid Pipe ———————

Perforated Pipe - - - - - - - - - - -

Split disposal fields using grid systems for both disposal fields.

Disposal Fields For Sloping Areas

(Other designs may also be acceptable)



All weeping laterals are laid level and follow the curve of the slope.

Prefered Method

Fig. DF 5

When the gravel under a weeping lateral is full of effluent, that weeping lateral will drain any surplus effluent to the next lateral through the solid piping that connects the laterals. This keeps the weeping lateral piping empty so it cannot freeze.

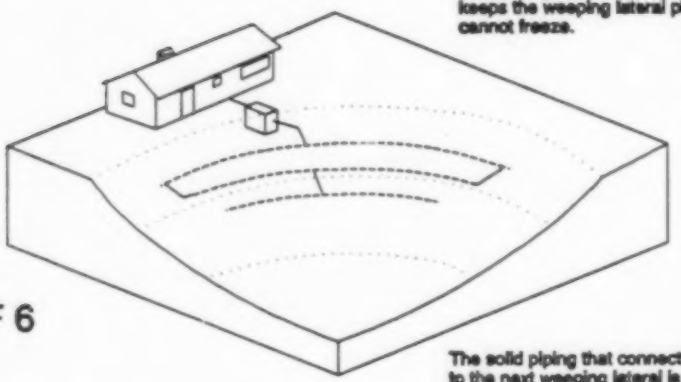


Fig. DF 6

The solid piping that connects one weeping lateral to the next weeping lateral is not laid on gravel to prevent the effluent from following the outside of the pipe to a lower level.
Solid piping is always sloped and is always encased in compacted soil (clay).

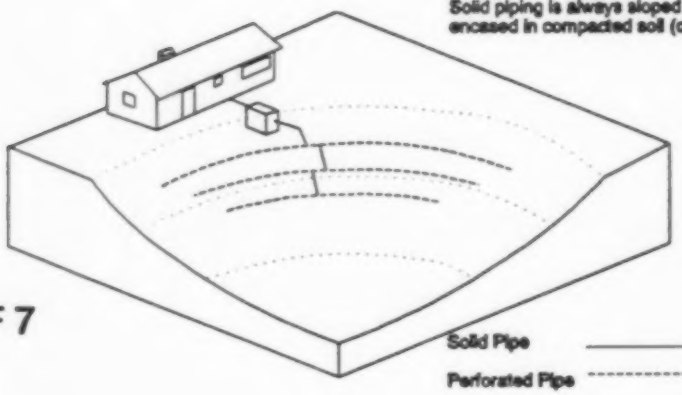


Fig. DF 7

Solid Pipe _____

Perforated Pipe ----------

Disposal Fields For Sloping Areas Using Drop Box

(Other designs may also be acceptable)

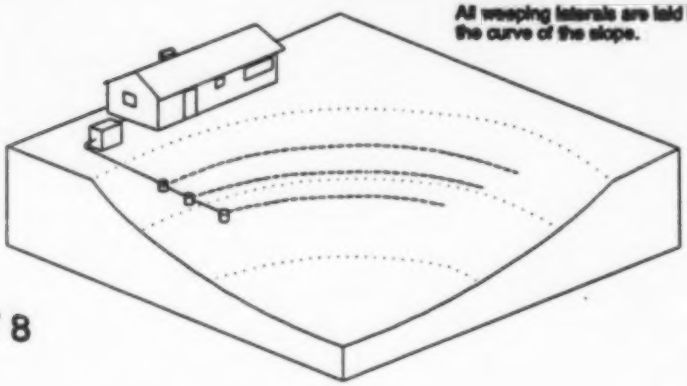
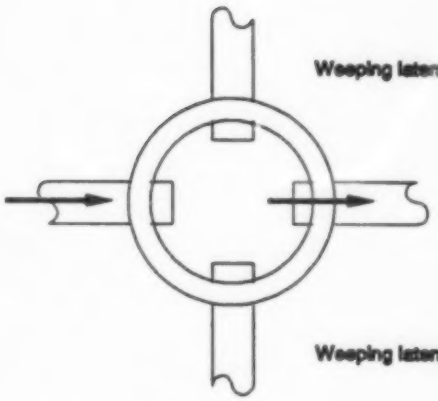


Fig. DF 8

Drop Box

Plan View



Elevation View

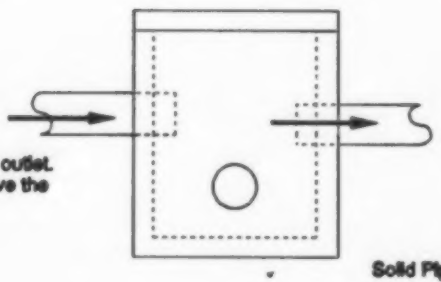

Inlet from septic tank or previous drop box.
25 mm (1 inch) above outlet.
75 mm (3 inches) above the weeping lateral(s).
Supply line to the next drop box
50 mm (2 inches) above the weeping lateral(s).

Fig. DF 9

Solid Pipe _____

Perforated Pipe ----------

Disposal Fields Using Bi-Level Cross

(Other designs may also be acceptable)

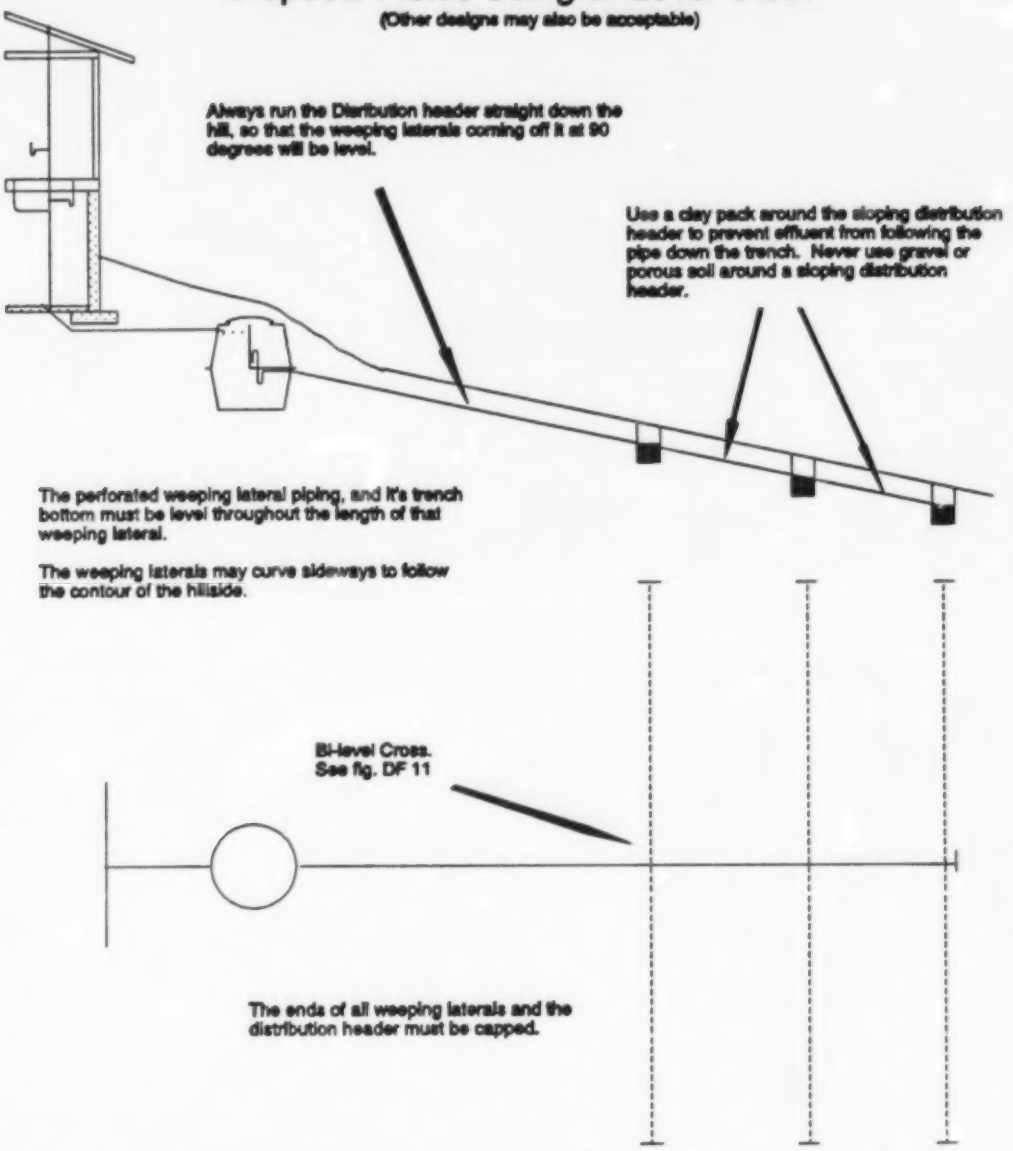
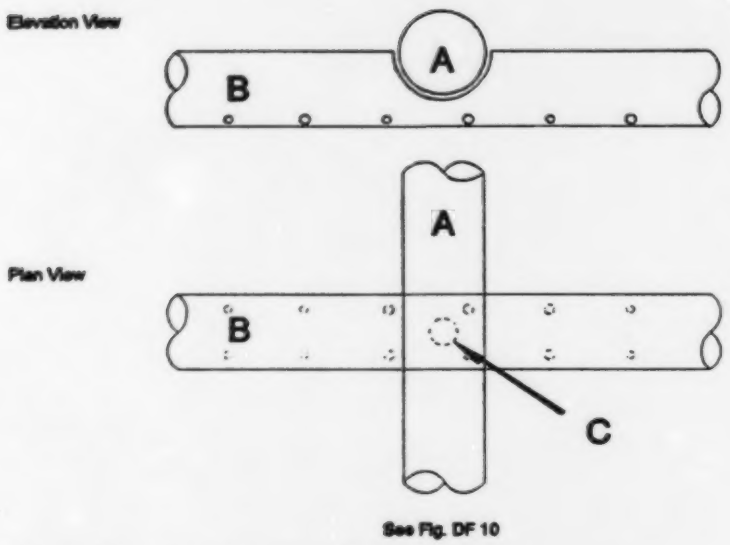

Always run the Distribution header straight down the hill, so that the weeping laterals coming off it at 90 degrees will be level.
Use a clay pack around the sloping distribution header to prevent effluent from following the pipe down the trench. Never use gravel or porous soil around a sloping distribution header.
The perforated weeping lateral piping, and it's trench bottom must be level throughout the length of that weeping lateral.
The weeping laterals may curve sideways to follow the contour of the hillside.
Bi-level Cross. See fig. DF 11
The ends of all weeping laterals and the distribution header must be capped.

Fig. DF 10

Bi-Level Cross



See Fig. DF 10

A. Water tight distribution header, surrounded by clay pack, not gravel.

B. Weeping Lateral.

C. Hole in the bottom of the distribution header "feeds each weeping lateral. The hole size will vary with the number of weeping laterals to be "fed", so that each weeping lateral will get it's share of each flush. For steeper slopes on the distribution header, increase the hole size. Bi-level crosses are not satisfactory for installation on slopes steeper than about 10%.

Cross wrap the two pipes together with plastic tape.

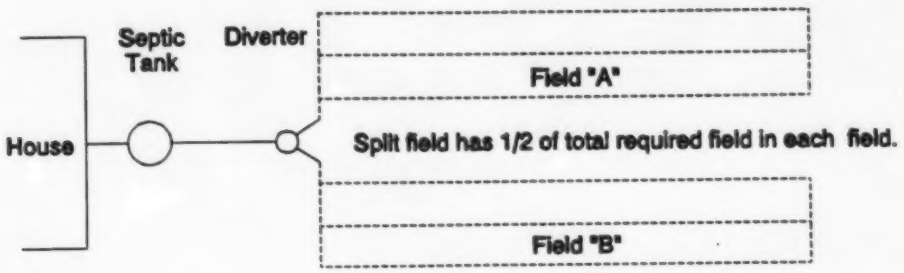
Suggested Hole Sizes (hole sizes may vary under different conditions)

Number of Weeping Laterals	Size of Holes
2	75 mm (3 inch)
3 - 4	50 mm (2 inch)
5 - 6	38 mm (1 1/2 inch)
7 - 10	32 mm (1 1/4 inch)
More than 10	25 mm (1 inch)

Fig. DF 11

Split Disposal Fields For Level Areas

(Other designs may also be acceptable)



Solid pipe _____

Perforated pipe .....

Fig. DF 12

Diverter

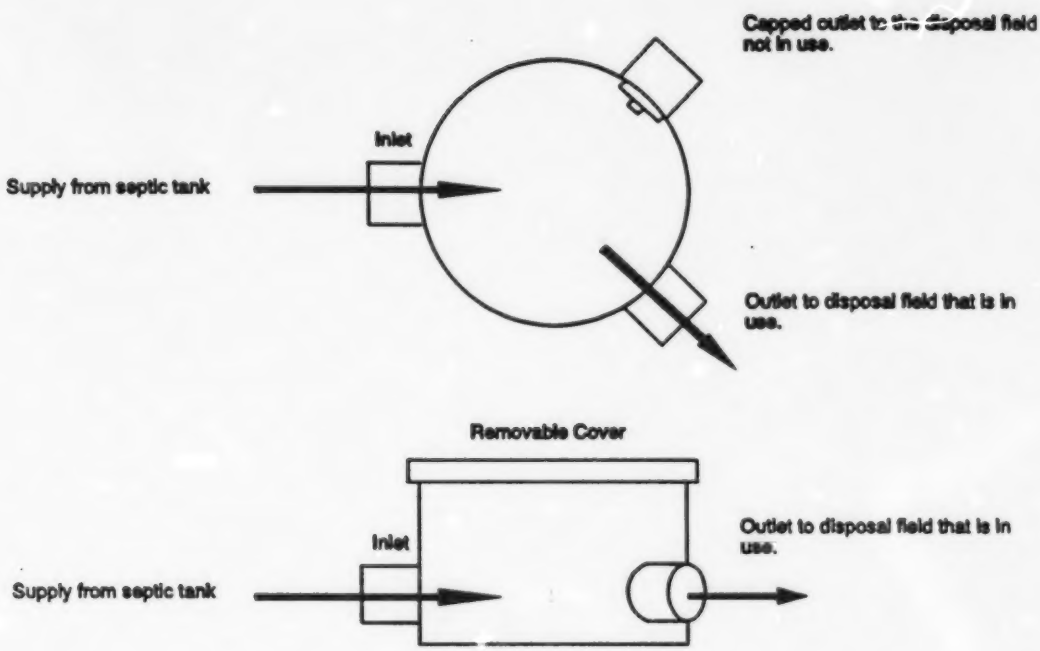
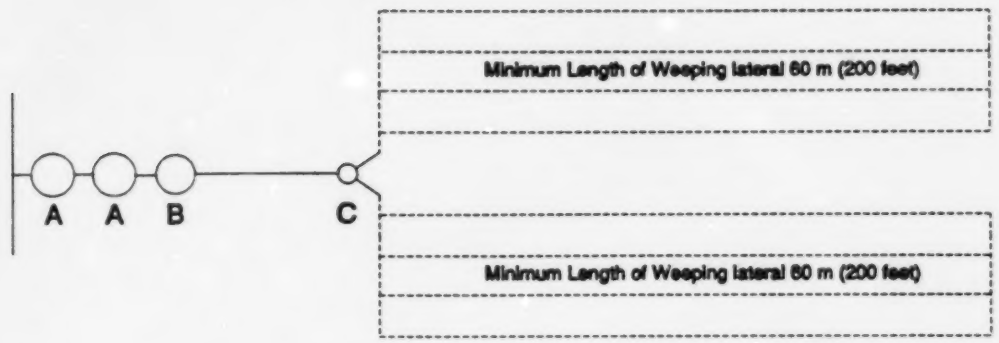

Capped outlet to the disposal field not in use.
Inlet
Supply from septic tank
Outlet to disposal field that is in use.
Removable Cover
Inlet
Outlet to disposal field that is in use.
Supply from septic tank

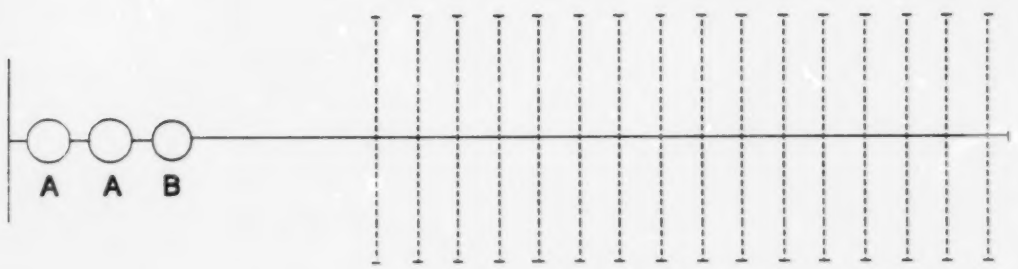
Fig. DF 13

Larger Disposal Fields Using Septic Tanks In Series

(Other designs may also be acceptable)



Split Field



Single large field

(A) Trickle type septic tanks in series to increase the "Working Capacity" of the septic tank as required.

(B) Trickle type septic tank being used as an effluent chamber. An effluent pump must be installed to pump the effluent to the disposal field. The effluent pump controls may be set to discharge a volume of effluent of between 4 to 8 Liters per meter (1/4 to 1/2 gallon per foot) of weeping lateral.

(C) Diverter to divert the effluent onto one disposal field or the other in a split field system.

Fig. DF 14

Treatment Mound Installation
Using A Deep Bury Pump Type Septic Tank
N.T.S.

(Other designs may also be acceptable)

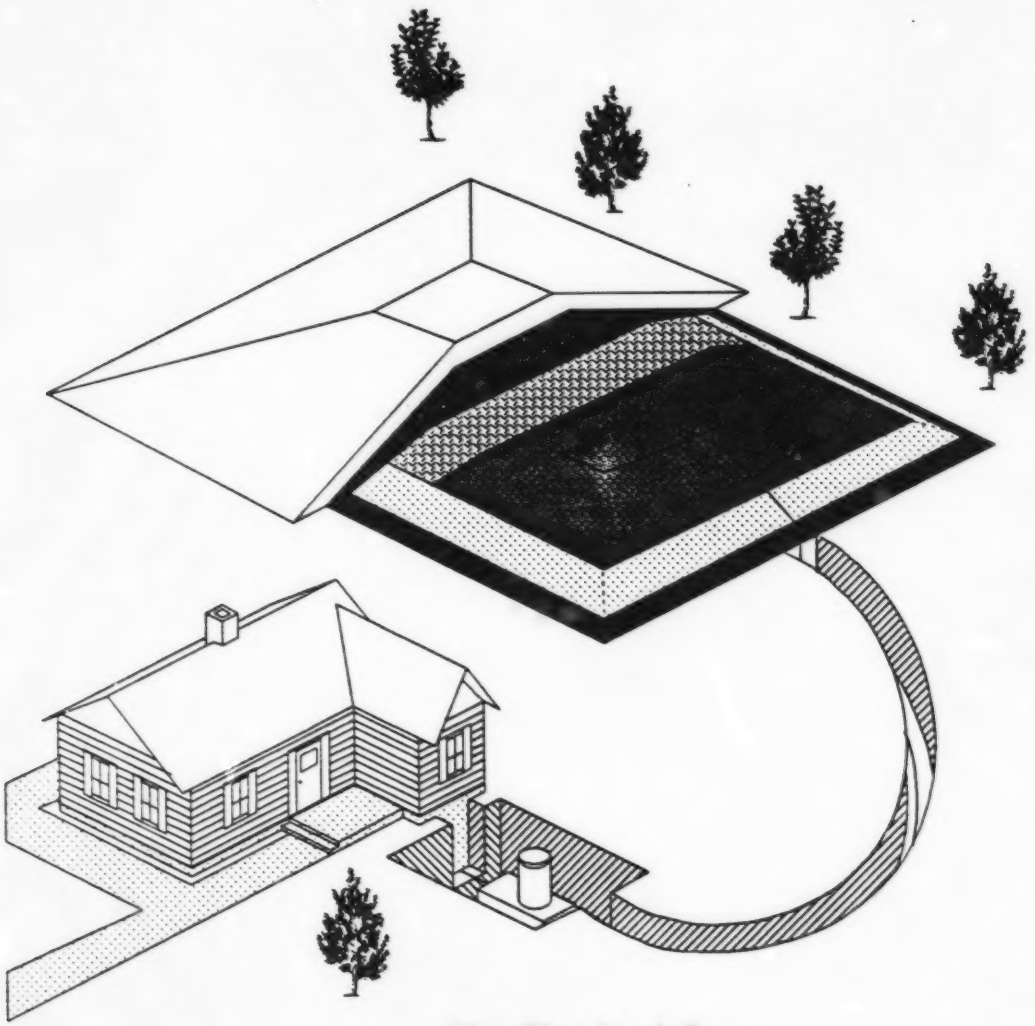


Fig.Typical 3

Mound

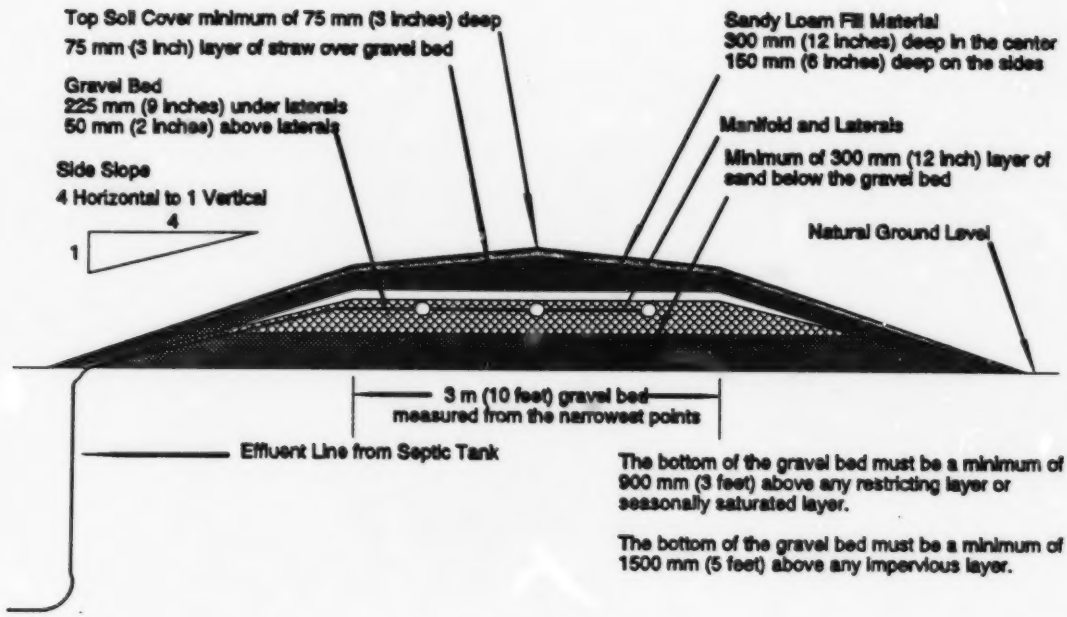

Top Soil Cover minimum of 75 mm (3 inches) deep
75 mm (3 inch) layer of straw over gravel bed
Gravel Bed
225 mm (9 inches) under laterals
50 mm (2 inches) above laterals
Side Slope
4 Horizontal to 1 Vertical
4
1
Sandy Loam Fill Material
300 mm (12 inches) deep in the center
150 mm (6 inches) deep on the sides
Manifold and Laterals
Minimum of 300 mm (12 inch) layer of sand below the gravel bed
Natural Ground Level
3 m (10 feet) gravel bed measured from the narroweet points
Effluent Line from Septic Tank
The bottom of the gravel bed must be a minimum of 900 mm (3 feet) above any restricting layer or seasonally saturated layer.
The bottom of the gravel bed must be a minimum of 1500 mm (5 feet) above any impervious layer.

Fig. M1

Laterals

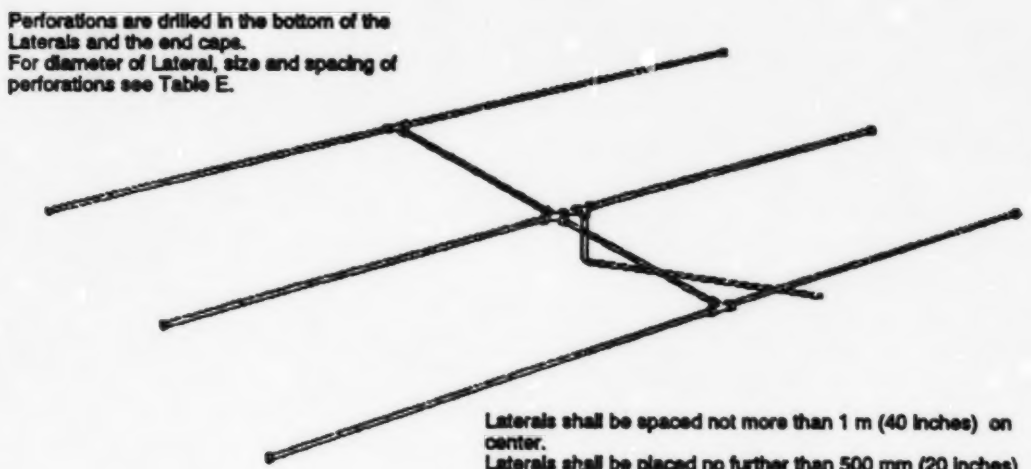

Perforations are drilled in the bottom of the Laterals and the end caps.
For diameter of Lateral, size and spacing of perforations see Table E.
Laterals shall be spaced not more than 1 m (40 inches) on center.
Laterals shall be placed no further than 500 mm (20 inches) from the edge of the Gravel Bed.

Fig. M2

The Rate of discharge per perforation size and Head pressure shall be calculated as in Table 8.6 B.

Laterals

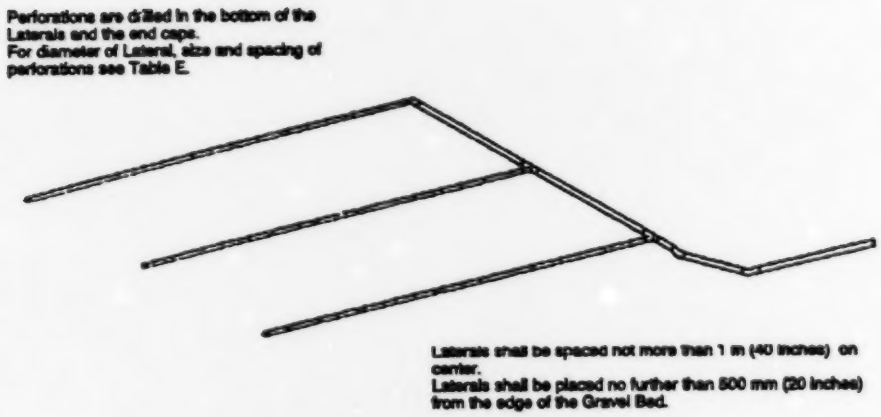

Perforations are drilled in the bottom of the Laterals and the end caps.
For diameter of Lateral, size and spacing of perforations see Table E.
Laterals shall be spaced not more than 1 m (40 inches) on center.
Laterals shall be placed no further than 500 mm (20 inches) from the edge of the Gravel Bed.

Fig. M3

Laterals

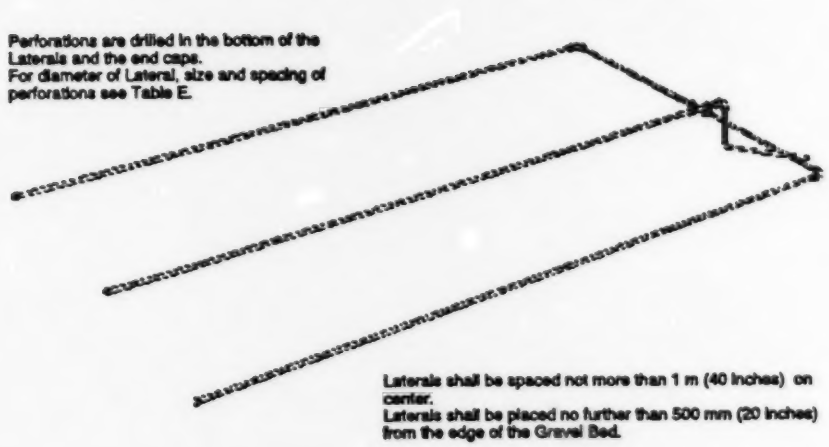

Perforations are drilled in the bottom of the Laterals and the end caps.
For diameter of Lateral, size and spacing of perforations see Table E.
Laterals shall be spaced not more than 1 m (40 inches) on center.
Laterals shall be placed no further than 500 mm (20 inches) from the edge of the Gravel Bed.

Fig. M4

The Rate of discharge per perforation size and Head pressure shall be calculated as in Table 8.6 B.

Open Discharge Installation
Using A Deep Bury Pump Type Septic Tank
N.T.S.

(Other designs may also be acceptable)

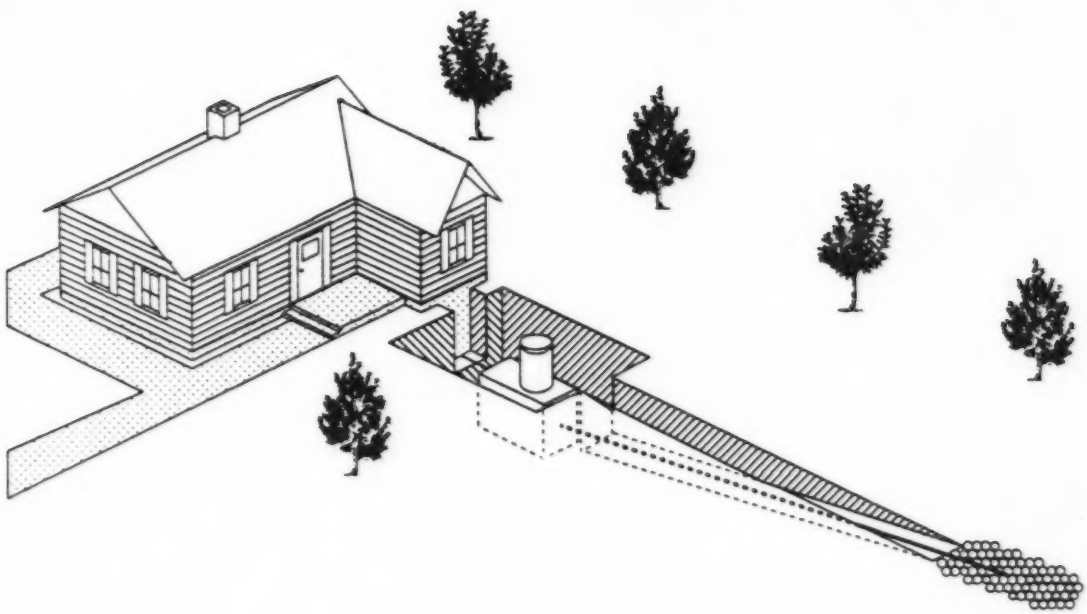


Fig.Typical 4

Open Discharge Installation Using A Shallow Bury Siphon Type Septic Tank N.T.S.

(Other designs may also be acceptable)

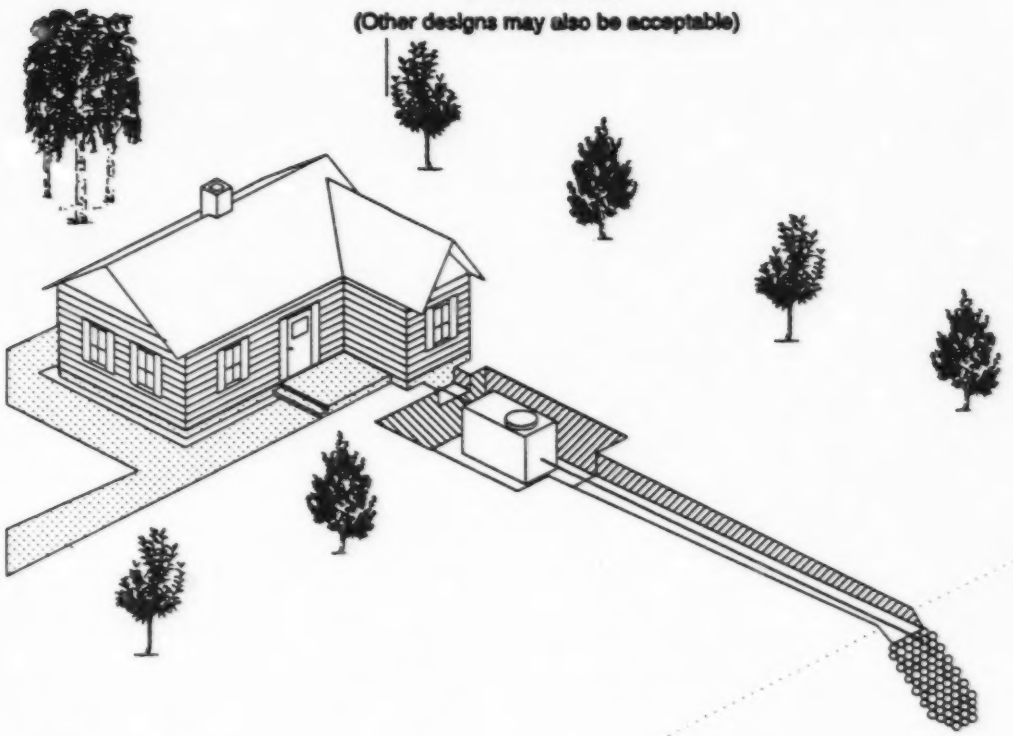


Fig.Typical 5

Open Discharge Installation Using A Shallow Bury Pump Type Septic Tank N.T.S.

(Other designs may also be acceptable)

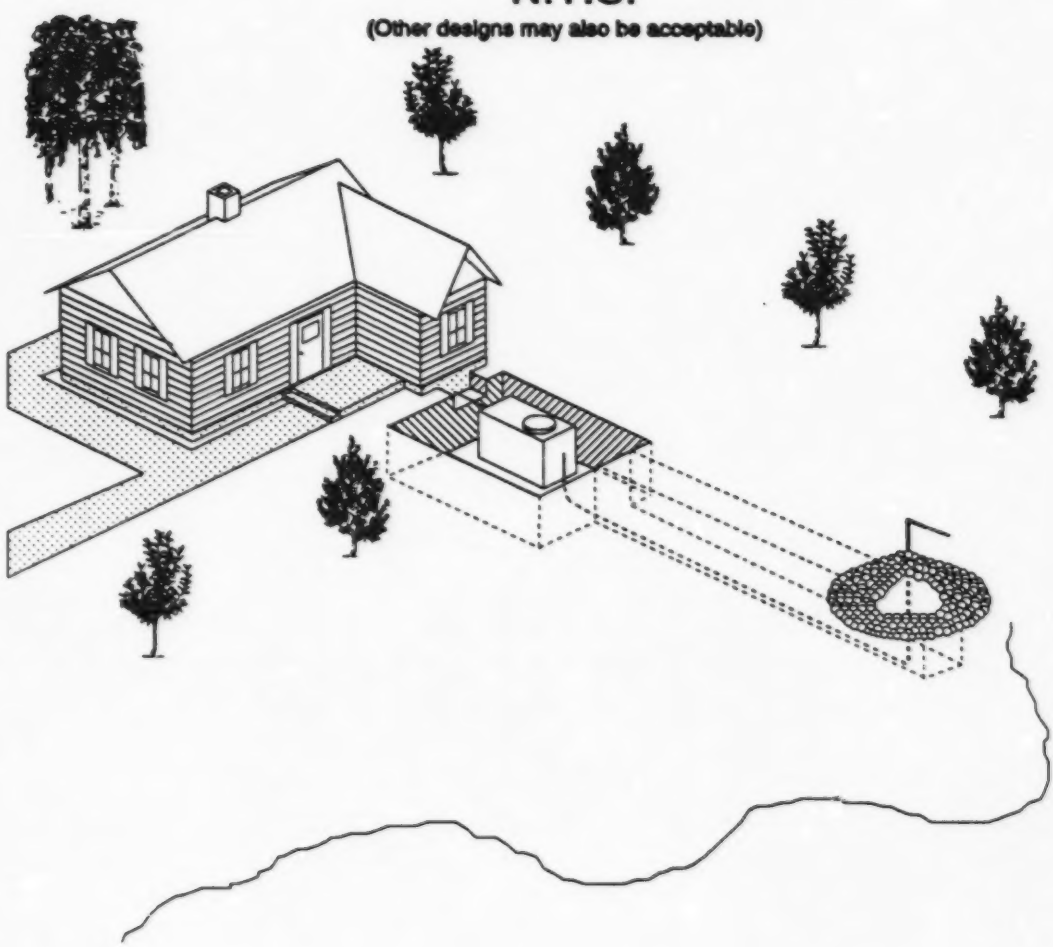
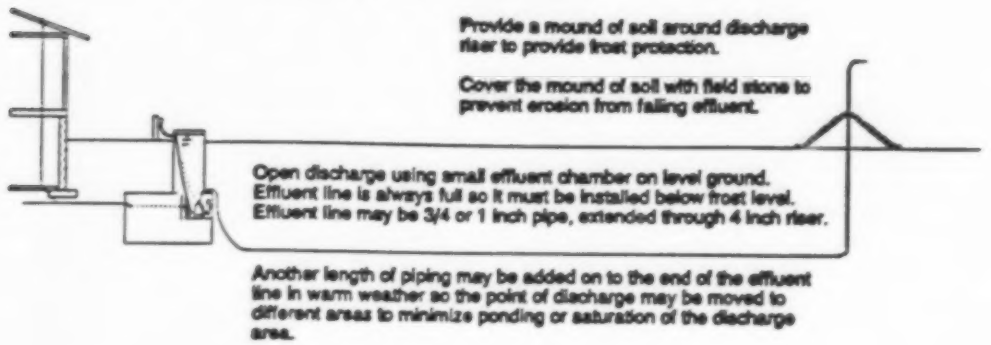
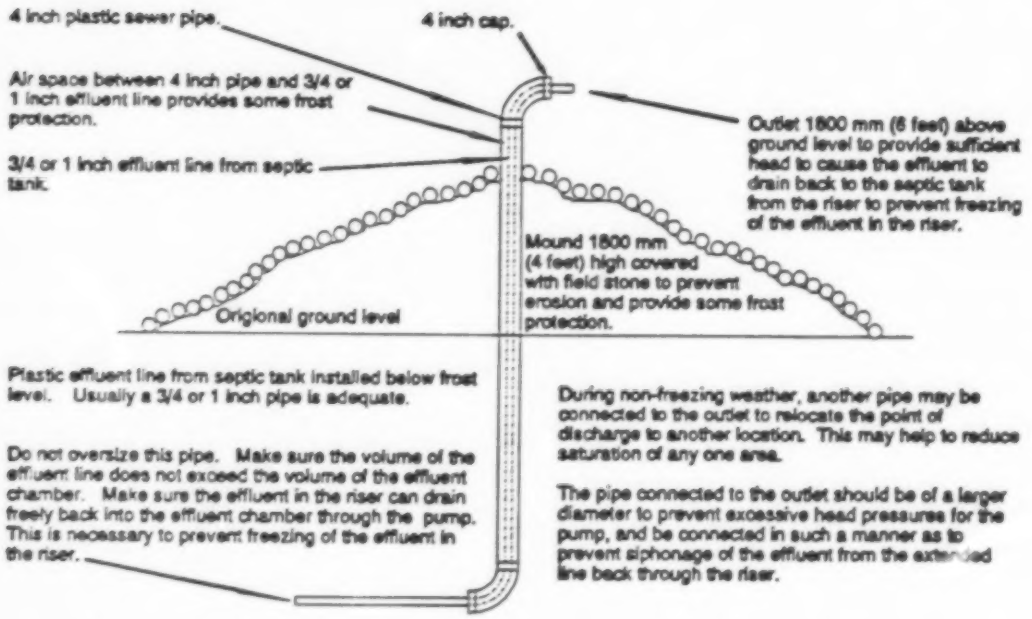


Fig.Typical 6

Open Discharge

(Other designs may also be acceptable)


Provide a mound of soil around discharge riser to provide frost protection.
Cover the mound of soil with field stone to prevent erosion from falling effluent.
Open discharge using small effluent chamber on level ground. Effluent line is always full so it must be installed below frost level. Effluent line may be 3/4 or 1 inch pipe, extended through 4 inch riser.
Another length of piping may be added on to the end of the effluent line in warm weather so the point of discharge may be moved to different areas to minimize ponding or saturation of the discharge area.

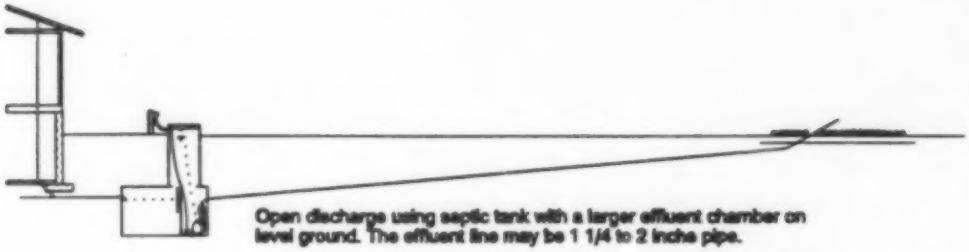

4 inch plastic sewer pipe.
4 inch cap.
Air space between 4 inch pipe and 3/4 or 1 inch effluent line provides some frost protection.
3/4 or 1 inch effluent line from septic tank.
Outlet 1800 mm (6 feet) above ground level to provide sufficient head to cause the effluent to drain back to the septic tank from the riser to prevent freezing of the effluent in the riser.
Mound 1800 mm (4 feet) high covered with field stone to prevent erosion and provide some frost protection.
Origional ground level
Plastic effluent line from septic tank installed below frost level. Usually a 3/4 or 1 inch pipe is adequate.
Do not oversize this pipe. Make sure the volume of the effluent line does not exceed the volume of the effluent chamber. Make sure the effluent in the riser can drain freely back into the effluent chamber through the pump. This is necessary to prevent freezing of the effluent in the riser.
During non-freezing weather, another pipe may be connected to the outlet to relocate the point of discharge to another location. This may help to reduce saturation of any one area.
The pipe connected to the outlet should be of a larger diameter to prevent excessive head pressures for the pump, and be connected in such a manner as to prevent siphonage of the effluent from the extended line back through the riser.

It is recommended to locate the open discharge outlet on higher ground than the septic tank, making it easier to drain the riser down to below frost level.

Fig. OD 1

Open Discharge

(Other designs may also be acceptable)

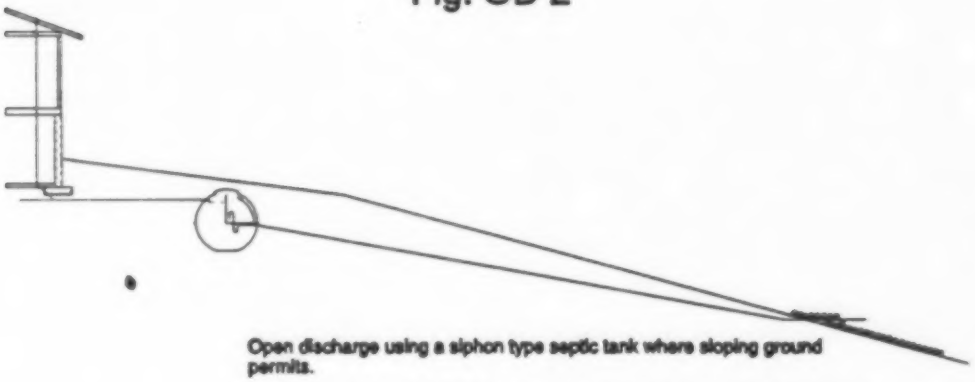


Open discharge using septic tank with a larger effluent chamber on level ground. The effluent line may be 1 1/4 to 2 inche pipe.

The effluent line must be carefully graded so the pipe can drain back into the septic tank between pump cycles to prevent freezing.

Field stone may be placed over and under the outlet for physical protection of the pipe and to prevent erosion from falling effluent .

Fig. OD 2



Open discharge using a siphon type septic tank where sloping ground permits.

The effluent sewer may be 3 or 4 inch pipe and field stone may be placed over and under the outlet for physical protection and to prevent erosion from falling effluent.

Care must be taken to insure there is no air circulation back through the effluent sewer and septic tank to prevent freezing of the septic tank in cold weather.

Fig. OD 3

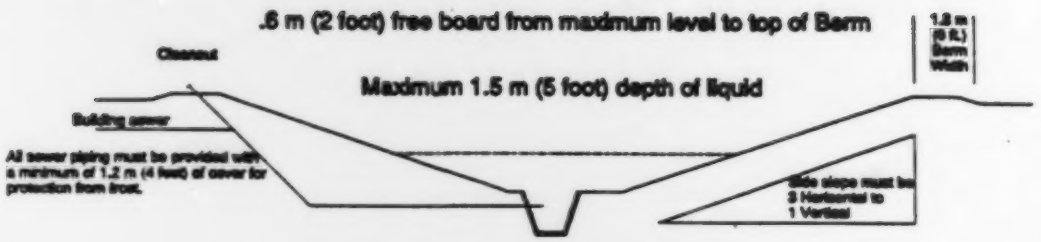
Sewage Lagoon Installation
N.T.S.

(Other designs may also be acceptable)

Fig.Typical 7

Lagoon

Elevation view

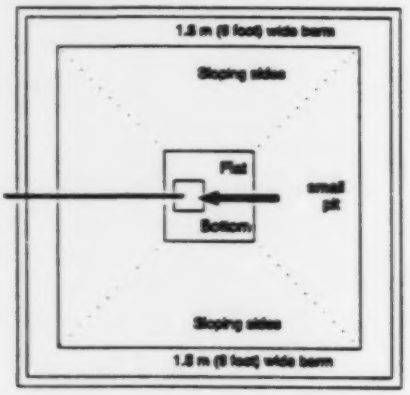

.6 m (2 foot) free board from maximum level to top of Berm
1.8 m (6 ft.) Berm Width
Cleanout
Maximum 1.5 m (5 foot) depth of liquid
Building sewer
All sewer piping must be provided with a minimum of 1.2 m (4 feet) of cover for protection from frost.
Side slope must be 3 Horizontal to 1 Vertical

Small Pit 2 m x 2 m (6 ft. x 6 ft.) rock or block lined

The building sewer should enter the small pit 600 mm (2 feet) below the bottom of the lagoon to provide sufficient liquid cover to prevent freezing.

The small pit (a small lagoon in a large lagoon) allows the large lagoon to be emptied, and so nearly doubles the capacity. If the small pit is not used, the large lagoon must retain .6 m (2 feet) of liquid to prevent the inlet piping from freezing.

Plan view



Fence the lagoon for safety.

Fig. L1